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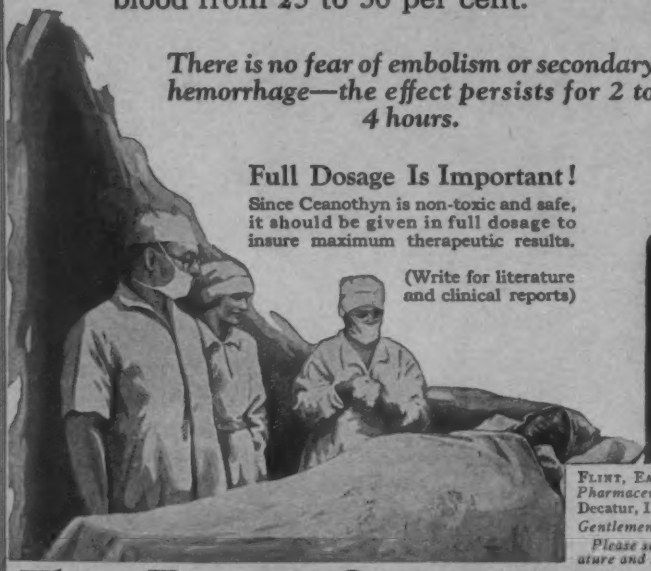

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THE
LARYNGOSCOPE.

VOL. XXXVIII JULY, 1928. No. 7

ORIGINAL COMMUNICATIONS.

(Original Communications are received with the understanding that they are contributed exclusively to THE LARYNGOSCOPE.)

OCULAR INVOLVEMENT IN SINUS DISEASES.*

DR. EDGAR S. THOMSON, New York.

So much has been written on certain eye diseases as the result of sinus infection during the past thirty years that any further communication may seem superfluous. And yet there are certain phases of the question that have received scant attention and upon which opinion is by no means unanimous. Optic nerve diseases are well recognized, but uveal diseases caused by sinus toxemia are somewhat in doubt. Also there is a constant disposition to watch for positive nasal symptoms and to doubt the latent cases in which very slight nasal or sinus symptoms exist. It is with especial reference to these two points that this paper, based on a series of private cases and numerous observations of cases in the Clinic at the Manhattan Eye, Ear and Throat Hospital, has been written. (The author wishes to acknowledge the cordial co-operation of Dr. J. E. MacKenty, Dr. E. R. Faulkner, Dr. W. R. Brandon, Dr. S. L. Craig and Dr. W. C. Bowers, who have operated on the cases in the private series, and of the Nose and Throat Staff of the Manhattan Eye, Ear and Throat Hospital.)

The early literature on this subject has been carefully collated by Eversbusch (Graefe-Saemisch, 1903), who credits as the early workers Berger-Tyrmann, Germann, Hajek, Kuhnt, Vossius, Winckler and Ziem. Mackay (Lancet, 1908) gives a classification of four groups of sinus diseases which affect the eye. First, mucoceles of

*Read, in part, at a meeting of the Section of Ophthalmology, New York Academy of Medicine, May 21, 1928.

the sinuses; second, cellulitis of the orbit or lids; third, sinusitis without external signs of orbital inflammation but with interior diseases, as optic neuritis, neuroretinitis, retinal thrombosis or phlebitis, or functional defects, visual or field, or external nerve disturbances; fourth, glaucoma, iritis, uveitis, keratitis, and lens and vitreous opacities. Mackay considered this last group questionable.

Certain early papers may be profitably quoted.

STANCULEANU, G.: Anatomical and Pathological Relations Between the Sinuses of the Face and the Orbitoocular Apparatus. These de Paris, 1902.

In discussing the anatomical and pathological relations between the facial sinuses and the orbito-ocular apparatus, the author points out, with special reference to the optic nerve, that all writers since Berger have emphasized the intimate relations existing between the optic nerve and the sphenoid sinus. But although this fact has been established positively from the anatomical viewpoint, this is not equally true clinically, so that whereas some physicians (oculists) see sphenoidal sinusitis everywhere, others (rhinologists) recognize it only too rarely. Berger and Kaplan point out three modes of propagation of the sinus inflammation to the optic nerve: *1*. Propagation of the osteitis affecting the sinus walls to the bony canal. *2*. By means of gaps situated at the level of the optic canal. *3*. The sinus inflammation passes first to the meninges and from there to the optic nerve surrounded by its meningeal sheath. In this case the nerve and its sheath are compressed, as it were, against its canal. To these mechanisms may be added regional edema. In a case of sinusitis published by Caubet and Druault, 1899, the neighboring cavities of the affected sinuses were filled with clear mucus, referred by them to irritation of the vicinity. When this transudation occurs at the level of the optic nerve, the nerve may be eventually irritated by this toxin-containing edema. Retrobulbar neuritis enters chiefly into consideration. The number of absolutely positive cases due to purulent inflammation of the sphenoidal sinus is not considerable. Close relations exist between the common motor oculi and the lateral wall of the sphenoid sinus, before this nerve penetrates into Zinn's foramen; and the author believes that it is at this point that the third pair is separately damaged in sphenoidal sinusitis. However, pathological observations on paralysis of the third pair in the course of sphenoidal sinusitis are very unusual; the author is enabled to contribute a personal observation. With respect to the external motor oculi, the medical literature to the author's knowledge contains only the observation of Panas, 1890, on paralysis of the sixth pair with

paralysis of the trigeminus of nasal origin. The superior maxillary nerve may be attacked either in its intracranial course, where the sphenoid sinus sends a lateral process into the great wings and the base of the pterygoid process, or in the background of the pterygoid fossa, or finally in its passage through the great foramen rotundum.

DE LA PERSONNE: Orbital and Ocular Complications of Sinus Inflammations. Clinique Ophthalmologique, 8:129, 1902.

The author proposes the following classification: *a.* Abscesses and encysted fluid gatherings in the orbit. *b.* Lesions of the adnexa of the eye, lachrymal passages, conjunctiva, eyelids, extrinsic muscles. *c.* Changes of the eyeball. Orbital abscess formation in acute sinusitis is a rare complication. Sometimes an abscess of the superointerior portion of the orbit first calls attention to acute sinusitis. In spite of acute oculo-orbital inflammatory phenomena, the pus has sometimes not yet broken through the sinus wall and must be sought by puncture. Abscesses followed by fistula in chronic empyema are the most frequent complication, preceded by an orbital phlegmon of more or less gradual development. Usually the development is slow, as a distinctive feature of retrobulbar from metastatic abscesses, which take a more acute and rapid course. The fistula is often situated at the level of the superointernal angle and most frequently caused by frontal sinusitis. Maxillary and ethmoid sinus abscesses more rarely give rise to orbital fistula. Abscesses with necrotic osteitis of the orbital walls: these large bony alterations occur especially in cases of maxillary sinusitis. When the other sinuses are involved at the same time, cerebral complications may supervene: intracerebral abscess in the case of the frontal sinus; purulent meningitis in the case of the ethmoid cells; thrombophlebitis of the cavernous sinuses in the case of the spheioid cavities. Rarely, thrombophlebitis of the ophthalmic veins and sinuses of the dura mater is observed as a sequel of sinus suppuration.

Concerning the neuroretinal apparatus, papillary congestion and optic neuritis are rare in frontal sinusitis, but are seen especially in sphenoidal sinusitis. Unilateral edematous optic neuritis should always cause suspicion as to an undiscovered sphenoidal sinusitis. Thrombosis of the central vein of the retina has been observed in a few cases. Retrobulbar neuritis or caudal perineuritis with an acute course has been held responsible for cases of sudden amaurosis or restriction of the visual field in the course of sphenoidal sinusitis. Atrophy of the optic papilla may be the result of the foregoing affections. Diminution of the central visual acuity and restriction of the visual field is seen more particularly in maxillary, more rarely in

frontal sinus inflammations. As to the pathogenesis of all orbito-ocular complications of sinus inflammation, infection is invariably responsible, except in certain mechanical disturbances. The question as to the mode of propagation varies according to the presence of suppurative lesions of the orbit or nonsuppurative lesions which reach the eyeball. In necrotic lesions of the bones of the orbit, and in suppurative lesions of the orbital tissue, the propagation takes place by the bony route. But the mechanism of this propagation through the Haversian canals, through intraosseous septic thrombosis, through intraosseous lymphangitis, still remains theoretical. The invasion may occur directly, in the presence of a gap or deficiency of the bony wall.

The author emphasizes the importance of polysinusitis and points out that sinusitis is rarely isolated, orbito-ocular complications in particular being most frequently dependent upon disease of several sinuses. When such complications are encountered in the course of maxillary sinusitis, it is necessary to look especially for participation of the posterior sinuses, without frontoethmoidal suppuration.

TERSON, A.: Orbitoocular Complications of Sinusitis. Clinique Ophthalmologique, 8:151, 1902.

The relations of the orbit with the sinuses are so close and direct that they would properly be designated as periorbital sinuses, a name suggested by the author over ten years ago. The terms of supra-orbital, sub-orbital and retro-orbital sinus are even more applicable, in his opinion, to the various sinuses than their customary designation. Precisely their juxtaorbital situation explains their pathological effects. In the course of the last few years, the author has observed several ocular lesions, some relatively benign, produced by sinusitis. He has also seen unilateral trigeminal neuralgia with unilateral asthenopia, referable to latent frontal sinusitis of several years' duration. In the course of a maxillary sinusitis in a woman age 30 years, detachment of the retina occurred and became total, without the formation of orbital phlegmon. In the case of an old man with long standing maxillary sinusitis, an extensive periostitis of the orbital floor developed, with exophthalmos and choked disc. The orbital abscess was opened and the maxillary sinusitis was likewise exposed through the alveolus. Fever and pus subsided on free drainage and irrigation, while the optic nerve underwent atrophy. The patient was apparently doing well, when a month later he succumbed to a rapidly developing meningoencephalitis. Repeatedly, the author has observed purulent dacryocystitis in patients suffering from sinusitis, evidently due to the same nasal infection.

ONODI, A.: Visual Disturbances and Blindness of Nasal Origin, Due to Diseases of the Posterior Accessory Sinuses. Zeitschrift fur Augenheilkunde, 12:13, 1904.

The author on the basis of his investigations points out that close relations of the optic canal exist as frequently with the sphenoid sinus as with the hindmost ethmoid cell. His investigations have furthermore shown that in all cases where the optic canal was related to the hindmost ethmoid cell, the partition was always extremely thin, like very fine paper. This usually established relation of the hindmost ethmoid cell with the optic nerve, also explains the frequent negative findings with respect to visual disturbances in empyema, caries and necrosis of the sphenoid sinus. In those cases where a close relation exists between the sphenoid sinus and the optic nerve, an inhibitory part may be played with respect to propagation of the process by the variable thickness of the sphenoid sinus wall at the level of the optic foramen. In those cases where the hindmost ethmoid cell forms the wall of the optic canal, the always extremely thin, paper-like partition may favor the propagation of the process. Dehiscences and gaps in the optic canal and at the anterior lateral wall of the sphenoid sinus may be direct causes of optic perineuritis and intracranial meningeal complications.

The following explanation can be given on the basis of the author's personal investigations for eventual unilateral visual disturbances in causative connection with accessory sinus suppurations. In the first place, it must be emphasized that unilateral visual disturbance in accessory sinus suppuration must not be exclusively referred to the sphenoid sinus, but the hindmost ethmoid cell must also be taken into consideration and be carefully examined. Close relations to the optic nerve are more rarely encountered on both sides, either on the part of the sphenoid sinus or the hindmost ethmoid cell; usually there is either; at the same time on one side the sphenoid sinus, and on the other side the hindmost ethmoid cell, related to the optic canal; or this relation exists only on one side, be it the sphenoid sinus or the hindmost ethmoid cell.

These relations may be taken into consideration in the often unilateral visual disturbances in connection with disease of the sphenoid sinus or the posterior ethmoid cell. In bilateral visual disturbances of nasal origin, the etiological basis may be formed not only by bilateral disease of the sphenoid sinus, but also by bilateral disease of the hindmost ethmoid cell. The author's experience also admits the possibility that an unilateral affection of the hindmost ethmoid cell may give rise to bilateral visual disturbances, because the large

hindmost ethmoid cell is separated extra- and intracanalicularly by a thin, paper-like common wall from the chiasma and from both optic nerves. The author has always spoken of the diseased hindmost ethmoid cell, on account of its close relation to the optic nerve; but it is well known and goes without saying that the hindmost ethmoid cell is affected together with the ethmoid labyrinth or the sphenoid sinus.

POLYAK, L.: Case of Latent Multiple Accessory Sinus Suppuration with Formation of a Bone Vesicle, Exophthalmos and Atrophy of Both Optic Nerves. Archiv. fur Laryngol., 15:340, 1904.

The author considers this case of latent accessory sinus suppuration in a man age 24 years as unique of its kind for the advanced dilatation of the bony walls of the suppurating accessory sinuses was associated with pressure atrophy of the optic nerves, bilateral exophthalmos, disfigurement of the nose, facial skeleton and hard palate. Five years ago the nose began to enlarge progressively, while the hard palate became depressed so as to interfere with breathing and swallowing. Four years ago, the visual acuity of the right eye rapidly diminished without pain or externally demonstrable changes, simultaneously with gradually developing exophthalmos of the left eye, whose visual acuity was at first preserved unchanged. A year later, the patient began to see worse also in this eye, and after some months became blind in both eyes. Exophthalmos of the right eye appeared one year after that of the left. There was no ocular pain or headache during the entire disease. The findings on examination apparently excluded a malignant character of the nasal tumor. Operation revealed an unusually large bone vesicle from which pus under a high pressure escaped on incision. The protrusion of the eyeballs slightly subsided after the removal of the tumor, although only to such a degree that the patient was enabled to close his eyelids. The blindness of course persisted unchanged. The nature of the disease in this case could be established only at the time of the operation, and the primary disease was shown to be the suppuration of the bone vesicle of the left middle turbinal. It is noteworthy that the patient during the entire course of the disease did not complain of headache or eye pain, not even at the time when the dilatation of the sphenoid sinuses and ethmoid cells occurred under such a high pressure as to lead to compression and atrophy of the optic nerves and to dislocation of the eyeballs.

CRAMER, E.: A Case of Superacute Suppuration of All Nasal Accessory Sinuses with Grave Involvement of the Eye. Klin. Monatsblatter f. Augenheilkunde, 1:69, 1906.

This unusual observation concerned an entirely healthy young man, age 26 years, who had never complained of the slightest disturbance on the part of the nose, but was suddenly attacked by severe right-sided frontal headache, fever and reddening of the right half of the face. When seen by the author a fortnight later, very marked chemosis was present, but in proportion to the severe swelling the mobility of the eyeball was still relatively good and its protrusion not very considerable. At the inner corneoscleral margin, a perforation about 1 c.m. long was evidently present, entirely covered by a layer of exudate. The iris was normal, pupillary reaction was normal. The inner eye was normal. The visual acuity could not be accurately tested on account of the patient's weakness, but was evidently still quite tolerable. Near the inner corneal margin a fistula was found from which masses of pus exuded. The catheter did not pass upwards, but deeply into the orbit and in a nasal direction. No roughened bone was felt. Percussion of the frontal sinus region elicited no painful sensation. On examination of the nose, pus was seen coming down from above. There evidently existed an empyema of the frontal and probably also of the ethmoid sinus. After removal of the layer of exudate, an oval defect without infiltrated margin appeared in the cornea, containing an iris prolapse, which was excised, and a covering flap of conjunctival tissue was fastened over it. The anterior chamber visibly became restored. By way of an incision passing in the eyebrow to somewhat below the root of the nose, the anterior wall of the frontal sinus was resected after pushing back the periosteum and soft parts, under careful preservation of the lower margin, as required for the intended subsequent Killian operation. An unusually large cavity was found, extending toward the temple to the region of the lateral orbital wall. It did not contain much pus, but the mucosa at many points was raised and loosened from the bony walls. The orbital roof on curettage was found to be very friable. Drainage to the nose was established by way of the internal nasal angle through the uppermost portion of the nasal process. The resected anterior wall on inspection was found to be softened and necrotic, indicative of still graver changes in the vicinity. The patient felt relieved after the operation, but when the dressings were removed on the third day, they were infiltrated with pus from the fistula as before, so that evidently the main focus had not yet been reached, in spite of the evacuation of the enormous cavity and deviation towards the nose. The corneal wound was in excellent condition, in spite of suture in the rigid chemotic tissue, but the visual capacity was reduced to the distinction of light and dark.

evidently as the result of involvement of the optic nerve. At the end of a few days, after the patient had somewhat recovered, the author proceeded to the performance of the typical operation. In spite of cautiously pushing aside the periosteum in the angle between the nasal root and the upper orbital margin, the eyeball burst wide open and the vitreous prolapsed so that immediate enucleation was required. On removal of the floor of the frontal sinus, with creation of the convenient access to the ethmoid cells, these were found to be in a state of total suppuration. On removal of the labyrinth with the sharp curette, the instrument dropped after a short time into the maxillary antrum and brought out masses of fetid pus. At the same time, also the inner portion of the inferior orbital wall was found to be necrotic. The outer wall of the maxillary antrum was rapidly chiseled off after detachment of the periosteum, and the cavity was carefully cleansed of all purulent remnants of mucosa. The subsequent course was extremely favorable, so that the irrigations could be begun after a few days. The fistula promptly closed and the skin wound healed, by first intention. The patient made a good recovery with only a slight disfigurement in the form of moderate flattening in the region of the eyebrow. The artificial eye is as movable as in entirely normal cases and lies at exactly the same level as the other eye. The pus contained only the ordinary pus cocci, not even pneumococci. According to the entire course of the disease, the dangerous rupture of the pus into the orbital cavity seems to have originated from a suppurative process in the maxillary antrum. The condition described in the foregoing, in the course of which one eye was destroyed and under a slightly longer delay, life itself would have been endangered through extension to the dura, renders it advisable carefully to examine the state of the accessory sinuses in every not evidently independent case of palpebral and conjunctival swelling, with prompt and radical treatment of eventual sinus affections.

These abstracts give an idea of the trend of thought twenty-five years ago. It would be tedious and unprofitable to attempt a complete review of all that has been written, but coming down at once to 1920 we find:

Bordley, Jas., Jr.: Optic Nerve Disturbances in Diseases of the Postnasal Sinus, Tr. Sec. Oph., A. M. A., p. 22, 1920, reports five cases in which exploration of the sinus revealed pus. "Assuming that the operator is qualified, and assuming also that all other probable causes have been eliminated, . . . I would suggest that when you are face to mace with a serious optic nerve disturbance the part of conservatism and good judgment requires operative explorations of the ethmoidal and sphenoidal cells."

ELLETT, G. C.: Optic Neuritis Associated with Disease of the Nasal Sinus. Tr. Sec. Oph., A. M. A., p. 33, 1920 (two cases in which sinuses were found full of pus).

GOURFEIN-WELT: Retinitis Following Upon Ethmoiditis. Revue Generale d'Ophthalmologie, 35:385, 1921.

This contribution comes from the Ophthalmological Clinic of the University of Geneva, and concerns a case of retinitis in the course of accessory sinus disease in a woman, age 40 years. After nasal treatment, which was followed by severe headache and epistaxis, a considerable diminution of the visual capacity of the homolateral, left, eye supervened. Examination by the author about six weeks later showed the presence of mild exophthalmos, a deviation of the bulb to the outside, considerable loss of vision, a central scotoma; the ophthalmoscope revealed a stellate figure in the environment of the macula and a large retinitis focus to the outer and inner side of the macula, with several small hemorrhages. The inferior temporal vein was strongly dilated and blurred in the region of the retinitic changes. The optic nerve was normal. Rhinological examination was now carried out and showed the presence of polypoid proliferations in the bilateral ethmoid cells, and a purulent inflammation on the side of the ocular changes. Some days after the evacuation of the affected accessory cavities, there occurred a considerable improvement of the visual capacity and a reduction in size of the central scotoma. This had disappeared at the end of three months, but a paracentral scotoma had appeared on the nasal side. The visual acuity amounted to one-sixth. The stellate figure had likewise disappeared. The focus beside the papilla was broken up into numerous small white dots, but the focus near the macula had continued to enlarge and also presented a few recent hemorrhages. The findings from now on remained unchanged. The transmission of the infection is assumed to have occurred by way of a retrograde thrombophlebitis by means of preexisting gaps of the lamina papyracea or eventual gaps made at the time of the first nasal operation. It is left unexplained why only the retina but not the optic nerve was affected. The author in conclusion points out that as all questions concerning ocular-orbital complications of sinus inflammations depend upon the competence of rhinologists as well as ophthalmologists, these conditions should be discussed by the combined Societies. Only by this collaboration will it prove possible to attain the desired end, namely a more accurate formulation of the data permitting a retinal affection to be referred to an affection of the ethmoid sinus; the discovery of the paths followed by the infection so as to become propagated from the eth-

moid focus to the retina; the demonstration of the operative indications, and the operative method to be employed.

COPPEZ: Optic Nerve Lesions Following Upon Endonasal Affections. Bull. de l'Acad. R. de Med. de Belgique, 5:121, 1922.

The close anatomical relations between the sphenoid sinus and the optic nerve at the level of the optic canal have long been known. The nerve is separated from the sinus only by a thin bony layer which may even present gaps, as has been shown by Gallemaerts. It is readily understood that a lesion of the sphenoid sinus may exert an injurious action on the fibres of the optic nerve and give rise to functional disturbances. These are almost pathognomonically characterized by the appearance of a central scotoma accompanied by an enlargement of the blind spot (symptom of van der Hoeve). The condition is a typical retrobulbar neuritis. In those cases where rhinoscopy reveals nothing suspicious, where the nasal mucosa appears healthy and no trace of purulent secretion is demonstrable, diaphanoscopy often reveals a very distinct shadow at the level of the ethmoid cells. Radiography confirms the preceding data. In pictures taken from in front, in normal subjects, the bony partitions of the ethmoid cells are seen in the form of distinct lines. In pathological conditions, uni- or bilateral total or partial confused shadows are seen, with disappearance of the outlines of the ethmoid cells. It is indispensable to take at the same time a lateral radiographic picture, which affords information as to the condition of the sphenoid sinus and the sella turcica. When intervention is decided upon, and on proceeding by the cutaneous route, so as to insure a free field of access, the condition is generally found to be no sinusitis in the classical sense of the term, but a more restricted lesion. The mucosa which lines the ethmoid cells is thicker and more turgid than normal; it is interspersed with fungosities, which may fill the cells; the bony walls of the cells are friable, roughened on touch, and sequestra are present. Sometimes there is a trace of pus, but this is the exception rather than the rule. An impression is conveyed of the ethmoid system being increased in size as a whole. On careful exploration of the ethmoid in the course of the intervention, an entirely posterior cell is sometimes discovered, interpolated between the optic canal and the sphenoid sinus, so that it must play an important pathogenic part. But this cell does not exist in many cases of retrobulbar neuritis. It is noteworthy that the maxillary sinus is generally involved; the pathological process often starts through the maxillary sinus, the ethmoiditis being merely secondary to the maxillary sinus inflammation. It must be kept in mind that retrobulbar neuritis of endonasal

origin is a serious disease. Although the visual disturbances sometimes undergo retrogression after a few days, the ultimate onset of a recurrence is not uncommon, as shown by seven personal observations. Neglect of the disease or too long delayed treatment terminates in total or partial atrophy of the optic nerve. In the majority of the cases, the peripheral visual field remains intact or nearly so, but central vision is definitely lost, with persistence of an absolute central scotoma measuring 10-15° in all directions. The patient is still able to move about, but can no longer read or write; fixation is altogether impossible. The ophthalmoscope shows pallor of the temporal half of the papilla, corresponding to the macular bundle of the optic nerve. The author had occasion to examine five patients with retrobulbar neuritis of variable duration where so far no diagnosis had been rendered. In nearly all of these cases evident signs of endonasal lesions were found. The question as to how ethmoid inflammations can exert an injurious action on the optic nerve is not easily answered. In the presence of sphenoidal sinusitis or lesion of a posterior ethmoid cell extending along the optic canal, a compression of the nerve may be assumed. In the cases of purulent ethmoiditis, the lesions of the optic nerve are attributed to orbital cellulitis; but empyema with involvement of the internal orbital wall and orbital phlegmon are often seen, giving rise to no lesion on the part of the optic nerve. In the cases here under consideration, there is disproportion between the very grave visual disturbances and the endonasal lesions, which are so indefinite as often to be overlooked. The question arises if these cases of retrobulbar neuritis can be likened to the cases of choroiditis recently reported by Gourfein-Welt, and attributed by her to ethmoiditis. She surmises that the lesion of the sinus extends to the chorioid by cellulitis, but this process does not explain why the axial bundle of the optic nerve is alone affected. Orbital cellulitis attaining the optic nerve must first act upon the sheaths and on the peripheral bundle of the nerve and induce at first not a central scotoma, but rather a restriction in sectors of the visual field. Summarizing, the foregoing observations show that a certain number of optic nerve atrophies are of endonasal origin; that this etiology, at first glance obscure, is demonstrated by diaphanoscopy and radiography; and that a timely intervention may have highly favorable results for vision.

DEMARIA, E. B., and LAYERA, J.: Retrobulbar Optic Neuritis in Disease of the Posterior Accessory Sinuses. Semana Medica, 29: 1057, 1922.

This observation concerned a man age 24 years, without special preceding diseases, who since a fortnight had noticed a deterioration

of vision in his right eye. At the same time there was an offensive whitish secretion from the nose, which increased on bending the body forwards. The visual capacity diminished from day to day. On examination, the right eye presented nothing unusual externally and internally. The visual field was normal in its outer limits, but there was a scotoma for white between 15 and 30 on the temporal side, and a larger scotoma for red and green. Vision, right side, one-tenth. Roentgen pictures showed right-sided maxillary sinusitis as well as ethmoidal and sphenoidal sinusitis. The diagnosis was retrobulbar neuritis due to inflammation of the ethmoid cells. Some days later the patient complained of diminished vision in the left eye, which was found to be externally and internally normal. The visual field showed a scotoma for white between 15 and 20, a larger scotoma for red, and a still larger scotoma for green; but these scotomas were smaller than in the right eye. After the performance of the operation according to Caldwell-Luc, a considerable dimunition of the symptoms promptly followed, so that the patient could soon be discharged from the hospital.

BRANDES: Three Cases of Acute Choroiretinitis of Ethmoidal Origin. Archiv. d. Ophthalmologie, 39:564, 1922.

The author reports three cases of rapid deterioration of the visual capacity in the presence of chronic ethmoid cell suppuration. Ophthalmoscopic examination showed brownish-yellow foci in the extreme periphery of the ocular fundus, promptly undergoing atrophy in 8 to 10 days. Collections of retinal pigment were seen in the center of the small foci. The onset was rather sudden, with rapid loss of vision. The history showed slight attacks of nose bleed and somewhat prolonged coryza dating back one, two and four years, respectively. Rhinological examination of the nose showed old chronic ethmoiditis in all three cases. Wide resection of the anterior ethmoidal cells with resection of the turbinals was performed, and pus was found in every instance. At the end of a month, vision was restored to normal in all cases. The author emphasizes the enormous importance of rhinological examination in acute or chronic affections of the choroid and retina. Slight attacks of epistaxis are sufficient to indicate a much more extensive affection of the ethmoid. Wide resection of the anterior ethmoid cells was the only treatment applied to these three cases. The blood route, a benign septicemia, is regarded by him as the path of propagation of the infectious agent to the choroid and retina. These cases were reported at the Congress of the French Ophthalmological Society, Paris, May, 1922. Duverger also observed cases of choroiretinitis in all ways comparable to those

shown by Brandes. Rapid decrease of vision; no nasal symptoms were present; nevertheless, the ethmoid was widely opened; no pus was found, but the ocular lesions healed without other treatment.

MORGAN, J. A.: A. J. of Oph., 7:459, 1924.

Reports a case of iritis (recurrent) in which opening of frontal and ethmoids was followed by intensification for one day, and then recovery. Pus was found.

PESME, P.: Acute Bilateral Retrobulbar Neuritis After Suppurative Sphenoidal-Ethmoidal Sinusitis. Annales d' Oculistique, 161: 507, 1924.

The author's case concerned a young woman, age 26 years, and was distinguished by blurred swelling of the papilla, otherwise rarely seen in retrobulbar neuritis, with a sharply outlined absolute central scotoma. The diagnosis of sinusitis was rendered by the rhinologist. Trephining of the sphenoid sinuses revealed a changed and infected mucosa. Curettage of the ethmoid cavities brought out inflammatory purulent detritus. The operative procedures were followed by a spontaneous cure, with restoration of the visual capacity to one-third. The history of this patient showed an acute bilateral retrobulbar neuritis in a case which at the same time presented a suppurative infection of the ethmoid and sphenoid sinuses on each side.

DEMARIA, E. (Buenos Aires): Acute Axial Optic Neuritis Due to Ethmoid-Sphenoid Sinusitis. Archiv. di Ottalmol., 24:113, 1924; Semana Medica, 31:539, 1924.

The author's personal observation concerned a woman, age 40 years, with a positive Wassermann test, whose illness began with fever, coryza, headache. The diagnosis was influenza. Twelve days later, after subsidence of the original manifestation, the patient presented the typical picture of left-sided retrobulbar neuritis, with slight reddening of the papilla, and sluggish reaction of the pupils to light; only movements of the hand were seen at the periphery. Six days later, the right eye became affected by the same phenomena. Intravenous injections of mercury cyanid proved unsuccessful. Local treatment consisted in homatropin, dionin, hot compress. Spinal puncture showed normal findings and had no influence on the disease. Three weeks after the onset of the ocular affection, the middle turbinals were removed, and the posterior ethmoid cells were opened, showing a thickened, puckered and whitish mucosa. Slight improvement. Three days later, the sphenoid cavities were opened; the right contained seropurulent fluid; the left had a thickened mucosa. Rapidly progressive diminution of the central scotomas followed, and

terminated in a complete cure. The condition is designated by the author as acute axial neuritis.

HERZOG, H.: Differential-Diagnostic Reflections on Retrobulbar Neuritis. Wiener Klin. Wchscrft., 37:972, 1924; Klin. Monatsblatter f. Augenheilkd., 73:545, 1924.

The relations between the nose and the optic nerve are very variegated. In the examination, an acute inflammation of the accessory sinuses must be looked for; a superficial examination is insufficient, and the entire territory must be systematically examined. Grave processes may exist also in the absence of free pus, as the deep layers of the mucosa pass without a boundary into the marrow spaces of the bones. Special attention must be given to inflammations in the posterior cellular system, the boundary region of the optic nerve, as the dural sheath may be involved. According to this interpretation, the injury of the optic nerve is a local circumscribed serous meningitis, which in most cases is elicited by way of the marrow spaces for the accessory cavities. Such an affection can often be demonstrated only by a microscopical examination after exploratory incision of the ethmoid bone. But in spite of the presence of such changes, the rhinogenic etiology of the optic nerve affection cannot be positively asserted, and exists in, at most, 10 per cent of the cases.

DAWSON, G. W.: Blindness and Other Ocular Defects Due to Nasal Disease. Lancet, 2:318, 1924.

Illustrative Cases: 1. Woman, age 31 years, sent to hospital for a vitreous effusion and opacities. General edema and turbidity each retina, suggesting septic absorption. There was aching around the left eye for several months, misty vision at times, and some nasal catarrh. The middle turbinates were large; these were removed and some ethmoid cells opened. No pus was seen. Improvement in condition was rapid.

2. Woman, age 29 years, history of some postnasal catarrh; choroiditis in both eyes for four years; at intervals, crops of spots appeared on the fundus, some of them becoming permanent, so that by this time she was nearly blind in the left eye. "In spite of the nose appearing normal, but taking into consideration the postnasal catarrh, the occipital headache, the pain in the ears, and the deep-seated aching behind the eyes, I determined to explore the ethmoid and sphenoid cavities. The ethmoid on both sides was found diseased, soft and easily broken down, evidently the seat of a chronic inflammation. The sphenoidal sinuses were opened, but no pus was seen. With the exception of a temporary crop of spots on the right fundus, a few weeks after the operation, she has had no further eye

trouble and the headache and aching at the back of the eyes have disappeared."

SIMONI-MECKLER, A.: Stasis of the Frontal Sinus Accompanied by Unilateral Retrobulbar Neuritis with Convergent Strabismus. Monatschrift. f. Ohrenheilkd. u. Laryng., 58:1126, 1924.

As a result of a stasis in the frontal sinus as well as in the entire right nasal cavity, retrobulbar neuritis supervened in a boy age 16 years. The divergent strabismus was presumably referable to the previously existing amblyopia of the right eye. The cause of the stasis consisted in extensive adenoid vegetations in the rhinopharynx, marked hypertrophy of the right middle turbinal and hypertrophy of the left lower turbinal, the operative removal of which was followed by considerable improvement of the visual acuity.

TOOKER, C. W.: Bilateral Papillitis Associated with Accessory Nasal Sinus Disease and Nephritis. *Am. J. of Oph.*, 8:878, 1925.

This observation concerned a young woman, age 24 years, who in the presence of a serious infection of the nasal sinuses presented diplopia and loss of vision, with bilateral papillitis. Cerebral, vascular and renal symptoms were likewise present. "The only discovered abnormalities in addition to the ocular findings were a nasal sinus infection, an albuminaria with casts, and a high blood pressure." Concerning the relationship of the nasal sinus infection to the papillitis, the author points out that various opinions are held by equally competent observers as to the production of a choked disc or of a papillitis of high degree by an infection in the nasal accessory sinuses. In the author's case, the improvement obtained may be attributed to the exenteration of the infected ethmoids and sphenoids and the subsequent depletion by hemorrhage.

MILLER, CLIFTON M.: Optic Neuropathy and Sphenoethmoid Disease. THE LARYNGOSCOPE, p. 687, 1925.

Thinks size of optic canal is a factor, and speaks of the gravity of the prognosis when the size of the optic canal is small, as shown by X-ray plates. Says, "Complete exenteration of the ethmoids is not necessary. Aeration and drainage is the object sought." Mentions two cases in which no pus was found, but recovery was complete.

"There is a class of cases of retrobulbar neuritis which seems never to progress to actual complete loss of vision, or are at any rate very slow in their progress in this direction. These cases are never hopeless from the standpoint of restoration of vision as long as there is no picture shown by the ophthalmoscope of optic nerve atrophy."

WHITE, LEON E.: Papilledema in Oto-Laryngology. Archiv. of Oph., p. 142, 1925.

He classifies papilledema as "marked", *i. e.*, 2 diopters, or over. In 75 cases of accessory sinus disease only three have shown edema of the disc. One had about 2 D., another about 3 D. One 2 D. Sluder mentions a case with a swelling of the disc of 6 D. in one eye and 8 D. in the other, arising from double sphenoiditis. "There are cases of edema of the optic disc which arise from accessory sinus infections."

"The swelling of the nerve head from accessory sinuses, teeth, or tonsils, being in the nature of a neuritis plus some swelling, would be well designated by the words "optic neuritis with edema", while the word "papilledema" should be reserved for the swellings associated with intracranial infections and the neoplasms accompanied with increased intracranial pressure."

2. White. "Bilateral edemas of the disc from intranasal infections have been reported; they are rare and need much more careful investigation, especially if the loss of vision is gradual." He also advises letting the sinuses alone unless they show evident infection. (With this opinion the author of the present paper does not agree. —E. S. T.)

FRANCIS, LEE M.: Certain Borderline Cases of Ophthal. and Rhinol. *Southern Med. Jour.*, p. 305, 1925.

"There is . . . a group of amblyopias, definitely dependent upon morbid processes in the accessory sinuses, the early recognition of which means relief and the saving of vision."

He lays stress on history of nasal infection, but thinks that its absence "should not throw the examiner off his guard". Rapidity of onset is important. Bilateral amblyopia is "not so common as unilateral". Enlargement of the blind spot is important. "When central scotoma is the dominant symptom, the infection is more apt to take place through the posterior vein of Vossius by which the toxemia is carried directly to the papillomacular bundles, according to Peter." This explanation has a rational anatomical basis and is substantiated by clinical experience—the rapid recovery of vision without further changes in the visual fields after the drainage of infected sinuses. The presence of pus or fluid in a sinus is, therefore, *not necessary* to establish a diagnosis of amblyopia from sinus involvement. He concludes: *1.* Suddenness of onset and rapidity of progress frequently without ophthalmoscopic changes. *2.* Usually unilateral disease. *3.* Early enlargement of the blind spot.

When weight of clinical evidence points to sinus involvement, "the drainage or ventilation of the suspected areas should be thorough and complete". He does not believe delay is justified because of negative rhinological reports.

ROUSSEAU, F.: Scleroconjunctivitis in the Course of Chronic Frontoethmoidal Sinusitis. Annales d' Oculistique, 162:525, 1925.

This observation concerned a patient age 23 years, with severe conjunctivitis of the left eye, which was very much reddened. This redness, suggesting both iritis and conjunctivitis, was due to the enormous dilatation of the capillaries of the bulbar conjunctiva and the episcleral reaction. In view of the unilateral character of the ocular affection, and its peculiar appearance, a lateral nasal sinus infection was suspected and rhinoscopy was performed, revealing the presence of chronic frontoethmoidal sinusitis. This was treated at first by inhalation of mentholated alcohol, 4 per cent, but this medical treatment proved insufficient and the author proceeded to resect the anterior two-thirds of the voluminous and hypertrophied middle turbinal, in order to drain the frontal sinus and the ethmoid. As improvement after this first operation was insufficient, the anterior ethmoid eight days later was curetted, causing a considerable diminution of the purulent discharge. The eye was still slightly reddened, but free from secretion, and the photophobia had disappeared. Six weeks later, the conjunctivitis and scleritis had disappeared, and there was no further functional disturbance. The foregoing case is an additional proof of the close connection between the eye and the nasal cavity with its accessory sinuses. These should be examined as a routine procedure in all cases of unilateral, somewhat typical conjunctivitis, in recurrent corneal ulcers on the same side, in all cases of iritis of unknown origin. Simple removal of the middle turbinal, supplemented or not by ethmoidal curettage, will cure as efficiently as a more serious operation such cases of retrobulbar optic neuritis, due to more or less latent sphenoid sinusitis or ethmoiditis, and in the majority of the cases will also cure acute frontal sinus suppurations which have resisted medical treatment.

CANUYT, G.; RAMADIER, J., and VELTER: Posterior Sinus Inflammations and Their Ocular Complications. Annal. d. Maladies de l'Oreille, 44:39:140, 1925.

The authors, two rhinologists and one ophthalmologist, discuss the latent accessory infections of the posterior ethmoid cells and sphenoid cavities, and their complications on the part of the eyes; under exclusion of the actual empyema of these sinuses. The eye complications caused by latent sphenoid and posterior ethmoid cell disease

are threefold: Motor disturbances, especially oculomotor, are very rare. Choroiditis and retinic changes are more common, but the diagnosis here must be very cautiously rendered. In a general way, changes of the retina and choroid referable to latent sinus inflammations are slight, sharply outlined, and leave few or no pigment lesions. The most important and by far the most frequent are visual disturbances through affections of the optic nerve, especially retrobulbar optic neuritis. In all cases of retrobulbar optic neuritis, a careful rhinological exploration of the posterior accessory sinuses is required after exclusion of all other etiological factors. In relatively rare cases, macroscopically demonstrable accessory sinus inflammations are found, more frequently sinusitis with microscopical changes, finally in a not inconsiderable remnant of cases, no pathologico-anatomical changes are demonstrable. The reason why, nevertheless, the operative intervention in nearly all cases is followed by a cure of the optic neuritis, is due in part to the close relations of the optic nerve with its vicinity, namely the posterior accessory sinuses, in part to the complicated anatomical relations in this region. The ocular complications which on the basis of their clinical behavior and their course can be referred to unrecognized and latent sinus affections, are as follows: *1.* Oculomotor disturbances. *2.* Lesions of choroiditis and choroiretinitis. *3.* Visual disturbances through involvement of the optic nerve. Choroiditis and choroiretinitis have so far been rarely reported as complications referable to sinus inflammation, but their existence does not seem to be doubtful. Their course under the influence of sinus treatment indicates their connection with latent sinus infection. Brandes, in 1922 reported three cases of acute choroiretinitis of ethmoid origin; the appearance of the choroiretinitic lesions was very characteristic: disseminated, rounded lesions, of yellowish color, of rapid development, some with complete absorption, others leaving a small discolored spot with a small mass of pigment in its center. Duverger and Lempert, in 1923, reported an analogous case, where the limited lesions of acute choroiretinitis rapidly healed after curettage of the ethmoid, leaving a few persistent choroidal cicatrices. Coppez also mentions several cases of choroiretinitis due to sinusitis. The interpretation of these conditions is always precarious; the etiology of such lesions can often be established only by exclusion, and sometimes can be merely surmised. In the foregoing cases, however, the certain existence of ethmoid lesions and the rapidly favorable result through local treatment are very valuable arguments in favor of sinus etiology. A question arises, especially from the practical viewpoint, as to the eventual existence of clinical signs which might permit the differ-

entiation of these forms of choroiretinitis of sinus origin from other forms of disseminated choroiretinitis. Apparently there are no undeniable distinctive signs; however, according to the reported facts, the lesions seem to be more limited, less confluent, more discrete, and leave no or nearly no pigmented spots behind them.

Mention must also be made of special forms of intraocular hypertension. Just as De la Personne, quoted by Lemaitre, in 1898, observed a case of inflammatory glaucoma referable to suppurative maxillary sinusitis, G. A. Weill has recently, 1924, reported a case where a sphenoethmoid infection was held responsible. These conditions are probably not glaucomas properly speaking, but iridocyclitis with hypertension, although great reserve is indicated in the etiological interpretation of these cases.

FRANK-KAMENETZKI, S., and BOLOTOR, A.: Rhinogenic Inflammation of the Optic Nerve. Zentralblatt f. d. ges. Ophthalmol., 18: 110, 1926.

In the case of a patient, age 26 years, a diminution of visual acuity in the right eye supervened and rapidly progressed up to a total loss of light sensation, under manifestations of headache, vomiting and general malaise, followed by absolute blindness in the course of 18 days. Ophtholmoscopy showed edematous neuritis of the optic nerve. There was paresis of the external oblique muscles. The Wassermann reaction was negative. Rhinoscopical examination showed on the right side, swelling and hyperemia of the middle nasal turbinal, with a mucopurulent discharge from the upper nasal meatus. Treatment: potassium iodid internally, painting with a 20 per cent cocain solution with adrenalin of the middle nasal turbinal and middle meatus. At the end of the first month after institution of the treatment, the visual acuity of the right eye was 0.8, and the papilla was nearly normal. After half a year, the visual acuity was restored to normal, the visual field was normal, and there was no diplopia. Inflammatory manifestations on the part of the nasal cavity were absent.

STAMBERGER, J.: Iridocyclitis Caused by Maxillary Sinus Suppuration. Recovery After Radical Operation. Zentralblatt f. d. ges. Ophthalmol., 16:738, 1926.

This observation concerned a young woman, age 27 years, with iridocyclitis of the left eye, with numerous adhesions and some exudate in the pupil. Vision, five-tenths. The rhinoscopical and Roentgen findings were negative, but puncture of the left maxillary antrum yielded pus. Repeated irrigations of the cavity having proved unsuccessful, a radical operation was performed according to Denker;

much pus was found, with a degenerated and polypoid mucosa. Eight days later the iridocyclitis had healed without leaving a trace, with vision, five-sixths. Attention is called to the relative rarity of inflammation of the uveal tract as a sequel of accessory sinus suppuration.

It will be noted that uveal diseases are infrequently mentioned, and that only occasionally is there any tendency to explore the sinuses in the absence of positive nasal findings. Optic nerve diseases are constantly mentioned.

CRANE: The Anatomical, Pathological and Clinical Relationship of the Posterior Sinuses to Optic Neuritis, Tr. Am. Lar., R. and Oto. Soc., 1926, in a very thorough and interesting paper says: "Operative measures should be instituted for all cases in which no known cause can be determined other than possible sinus disease. . . . This is particularly true if the blindness is complete or progressing, or of considerable duration."

CHARACTERISTICS OF SINUS DISEASE.

Something should be said concerning the nature of sinus disease capable of causing focal infection, although the true pathology of certain types is not fully understood. It has for some time been conceded that purulent disease in a confined cell, or even in the general cavities when drainage is insufficient, can and at times does cause focal infection, or inflammation by direct extension. Probably in these cases there is an element of mechanical pressure at first, and finally extension by the blood or lymph channels. In the case of the optic nerve there may be direct extension through periostitis of the wall of the optic foramen or pressure from the products of inflammation.

These cases of optic nerve disease do not, strictly speaking, belong in the category of focal infections, which term belongs more properly to uveal or retinal inflammations caused by disease of the antrum, ethmoid or more distant tissue. There is, however, another type of sinus disease, especially in the ethmoids, or sphenoid, in which local inflammation is not evident and yet in which plastic inflammation of the retina and uvea, and marked functional disturbances of the optic nerve do take place. These cases frequently give a meager history of nasal disturbances, examination shows little that is suggestive, X-ray pictures give negative results, and when the sinuses are opened the local appearances give no definite facts. Some authorities speak of a deeper color in the mucous membrane with some thickening and perhaps abnormal softening of the ethmoidal septa, or eburnation of

the sphenoidal wall. Also there may be suggestive symptoms in the nose, as a deflected septum, insufficient drainage, greater bacterial activity on one side than the other, etc., and recurrent attacks of acute coryza—questions which, as they come more especially within the domain of the rhinologist, will not be discussed here. There is by no means a general agreement on these questions, but MacKenty (p. c.) finds evidences of osteitis, clinically and microscopically, and in certain cases he finds a greater tendency than in others for the sphenoidal opening to close through the formation of new bone. What makes the diagnosis clear is the fact that after operation the process in the eye resolves in a manner that would not be readily conceivable unless the toxic or mechanical cause had been removed.

It is evident from the foregoing that the question of the advisability of operation must be decided mainly by the clinical picture in the eye, and that in certain cases the sinus operation must be considered in the nature of an exploratory one. This was a rather serious decision in the days when a sinus operation was a more dangerous procedure; but at the present time, with modern technique, the danger is reduced to a minimum and is not to be considered as against the loss of vision. MacKenty (p. c.) believes that all septal tissue in the ethmoids should be removed and the ethmoids converted into a single clean cavity, and that if this be done the danger of hemorrhage is reduced to a minimum. He does a complete radical intranasal pansinus operation on the affected side. A submucous resection of the nasal septum is done at the same time to give more room for the procedure. Every ethmoid cell is removed out to the orbital plate and up to the base plate. By this procedure the cells on the floor of the frontal are thoroughly removed and of necessity the frontal sinus stands well open. The entire anterior sphenoid wall is taken down. The antrum is opened as widely as possible under the inferior turbinate. If the other side is evidently diseased it is similarly treated. His reasons for such a radical procedure are that any ethmoid cells left are closed by the traumatism of the operation, their drainage interfered with, and they are potential sources of future trouble. This throws the ethmoid labyrinth and sphenoid into the nasal cavity. Great care must be taken not to injure the orbital wall or the base plate, and the sphenoid should never be curetted.

The operative procedure usually adopted by Faulkner (p. c.) is a thorough intranasal exenteration of the ethmoids, with enlargement of the sphenoid opening sufficient for drainage and subsequent treatment. An intranasal opening in the antrum is usually sufficient but in some cases a radical antrum operation may be necessary. The

frontal sinus very rarely acts as a focus of infection on account of its drainage opening being in a more dependent position.

A unilateral operation may be sufficient but more frequently both sides will have to be operated on. Tonsillectomy is necessary in nearly all cases and has a favorable influence in enabling the patient to overcome the infection in the sinuses. A submucous resection of the septum should be performed to give better access to the surgical field.

As stated before, there is a very important class of cases in which local signs fail and the process is undoubtedly one involving or centering in the bone. These cases are very apt to be overlooked through undue caution in waiting for the appearance of nasal symptoms. It cannot be too strongly stressed that if too great a period of time elapses irreparable damage to the eye will be done.

CLINICAL PICTURE IN THE EYE.

Iris and Ciliary Body: There seems to be no doubt but that iritis and cyclitis can occur as the result of latent sinus infection. Numerous cases have been reported in which a frank purulent discharge from the ethmoids exists, and in which exenteration was followed by subsidence of the iritis. The author has repeatedly seen the same thing happen in latent cases. These cases show little or no sinus symptoms. The iritis is of low degree, the eye not very red, the pain not very severe. Plastic formation is of marked degree when the ciliary body is involved, corneal precipitates occur, and where the choroid is involved vitreous exudates are present. The exudation in the anterior part of the uvea is apt to be much greater than the amount of hyperemia would indicate. One eye alone is involved, the other remaining perfectly normal. Simple iritis is not so apt to occur as an iridocyclitis, and on the other hand the ciliary involvement is apt to be of the "simple cyclitis" type without marked tension changes; in other words, the picture of a low grade toxemia without enough virulence to lead to rapidly destructive nutritional effects. The attack lasts a relatively short time in its acute stages, but plastic material clears up very slowly. If we assume for the sake of standardization that six weeks is about the average duration of an attack of syphilitic iritis (especially in presalvarsan days), these sinus cases will usually subside in a much shorter period, say from ten days to three weeks; that is, the redness and pain and irritative symptoms subside, while the exudations subside much more slowly, or perhaps persist until the sinus operation is done. The attack having subsided the eye remains quiescent for a variable length of time, and then a fresh attack occurs, which may be more severe but is frequently of

the same degree of intensity. Attacks may go on for a period of months or years. In one case reported they had continued for three years, in another for certainly more than fifteen years. The absence of any other cause found after careful physical and clinical examination is of course corroborative evidence. It need hardly be said that such examination is essential. Also the fact that as the attacks go on they remain confined to one eye is very suggestive of a local cause rather than a constitutional one. Syphilitis or digestive iritis invariably attacks both eyes, while focal iritis is unilateral.

Choroid: Two rather distinct types of choroidal reaction occur in sinus infection. These differ mainly in degree, but have rather distinct clinical peculiarities. The first type is shown principally by fine, dust-like opacities in the vitreous, which come on rather suddenly and run a very chronic course, sometimes increasing very slowly. At times choroidal exudations cannot be made out. No hyperemia occurs and tension changes are late; in other words, are probably dependent on extension to the ciliary body. The diagnosis in these cases is difficult, as the condition is frequently bilateral and the toxemia of so low a degree that it may come from a variety of causes, especially in those beyond middle life. The diagnosis can only be made by exclusion, and if careful physical and clinical examination gives no definite cause, exenteration of the ethmoids is certainly justifiable, particularly if the opacities are increasing and the vision is falling. The other type begins with plastic exudations in the choroid of a greater or less degree of severity, and often goes on to dense vitreous clouding and serious intraocular changes. It is always monocular and comes on at times with considerable violence. Time is of great importance, especially in those cases which develop vitreous opacity, and the general examination should be made as rapidly as possible so that the sinus operation may be done promptly. Even in cases that are properly judged such dense vitreous opacity clears up slowly, over a period of three or four months, or more, and at times leaves serious secondary changes. Cataract may occur, or tension changes, or a very curious cupping of the nerve even where no material increase of tension has been demonstrable. Where no vitreous opacity occurs the question is simply to operate soon so as to secure prompt absorption of the choroidal exudates and a minimum of tissue damage. Naturally we should act more promptly if the exudation is in the macular region.

Retina: It is doubtful if a pure retinitis occurs as the result of sinus infection. Certainly if it does occur it must be of very low degree. On the other hand, it is scarcely conceivable that a choroid-

itis of any degree be not accompanied by retinal involvement. In fact, the sinus toxemias very commonly attack choroid, retina and nerve at one and the same time, though perhaps the choroid is the more susceptible. This must be understood as applying to focal infections from ethmoid, sphenoid or antrum disease, or multiple sinusitis. In the case of the special forms of optic nerve disease from sphenoid, or perhaps posterior ethmoid infection, to be mentioned later, the process is perhaps a direct extension or the result of mechanical pressure and should not be classed with the focal infections. In any event, the proximity of the process has something to do with the infection, *i. e.*, a right-sided retinochoroiditis will be caused by infection of the right ethmoidal and sphenoidal region. Retinal involvement is shown by edema, possibly so slight as to give metamorphopsia with little to be seen by the ophthalmoscope, areas of whitish edema which may be extensive, superficial exudates, thrombosed vessels, and superficial hemorrhages. Field changes and scotomata are very marked and will materially aid in the diagnosis. Loss of color perception occurs in the affected areas, though this represents only a slight degree of retinal involvement. If the involvement be more extensive, light perception in the scotoma may be entirely lost. As in other retinochoroidal inflammations, the prognosis is made much more serious by the presence of retinal lesions, and operation should be done early if permanent retinal damage is to be avoided.

Optic Nerve: The optic nerve may be the seat of plastic inflammation as the result of sinus disease, either singly or accompanied by lesions of the retina and choroid. Even in cases where the nerve is mainly affected, retinochoroidal exudates situated close to the nerve are apt to occur and this feature is a suggestive diagnostic point. The nerve is not greatly swollen (less than 2 D. normally, although cases do occur where swelling is much higher, even up to 6 or 7 D.), but is quite red, with blurry outlines and tortuous vessels; in other words, a picture of marked toxic involvement. Later on, hemorrhages appear and plastic exudates become more marked. Vision falls rapidly and the blind spot is enlarged. Field disturbances do not occur until atrophic changes begin. The fact that the disturbance is one-sided is a very important point in the diagnosis, for inflammation of the optic nerve from general causes, syphilis, etc., is most apt to involve both sides, although one eye may be worse than the other. The more advanced the lesion is on one side, in the presence of a normal nerve on the opposite side, the more suggestive the picture is of sinus disease.

A second type of optic nerve disturbance takes the form of retrobulbar neuritis of low degree, depending upon the part of the nerve to be affected. The nerve is slightly white and blurry, with vessels either not changed or diminished in size. Vision is markedly reduced, the blind spot is enlarged, and the field may be contracted; in other words, the picture of a plastic inflammation in the retrobulbar portion of the nerve with a certain amount of mechanical pressure. Changes in color perception are more common than in the former type, and consist in contractions of the color field, and possibly central scotoma. Both these types require early operation if atrophy is not to ensue, the retrobulbar type being perhaps the more urgent.

A third type gives marked functional depression, with no change in the appearance of the optic nerve. The pathology in these cases is obscure, and while the theories of infection and pressure both have their advocates, it cannot be said that either has been definitely established. Central color scotoma is relatively common in these cases, and concentric contraction of the form field occurs, usually after the vision has been depressed for some weeks. The visual acuity usually falls off rapidly to 20/70 or 20/200, and then remains the same for a variable length of time. As long as the ophthalmoscopic appearance of the nerve is normal a complete return of function is not only possible but probable, while if the sinus operation be not done atrophy of the nerve eventually ensues.

Both sides may be affected and one is usually much worse than the other. This adds to the difficulty in diagnosis, but as the process is not a rapid one a reasonable time can be taken for study and exclusion of other causes. Hysteria must, of course, be carefully excluded, but those who have studied this type of case will usually have little difficulty. The fixed character of the visual tests, the absence of hysterical suggestions, the sluggishness of the pupil, the consistency of the symptoms, are all important as establishing the diagnosis of sinus disease. After operation the return to normal vision occurs so rapidly as to seem nothing short of miraculous. It is not unusual to have vision of 8/200 to 10/200 return to 20/15 in two or three days. This recovery of vision after a period of depression, lasting sometimes several months, makes it difficult to imagine that plastic exudation may be the cause of the process. Plastic exudation would not clear up so quickly and would certainly leave destructive changes after such a length of time. Also very severe pressure would seem to be precluded, as in cases of demonstrable pressure, enough to seriously cut down function, as in tumor or hemorrhage, atrophy occurs with relative promptness.

In this type of case it is quite usual to find no local changes in the sinuses. The rhinologist in operating seems to be working in normal tissue. Nevertheless a complete opening of the sphenoid and ethmoids should be done, on both sides if both optic nerves be affected.

A pure papilledema does not occur as the result of sinus disease. (Horrax, Gilbert: The Significance of Papilledema to the Neurological Surgeon. Arch. of Oph., p. 130, 1925.) Reporting five brain tumor cases, he says: "A measured elevation of 4 D. could not conceivably be caused by anything but mechanical pressure." (See Cushing, *Jour., A. M. A.*, pp. 236-7, 75, July 24, 1920.) "In the vast proportion of cases, papilledema means brain tumor, or at least a surgical intracranial condition equivalent to it."

The type of disturbance that may be looked for in a given case: In the first place, eye affections in sinus disease are relatively uncommon. The private series reported is taken from over 9,000 cases and represents 44 cases of eye involvement. A few tonsillar cases are included, mainly those in which a sinus sensitization seemed a part of the process. That is to say, in the vast majority of cases of sinusitis no ocular disturbance occurs. In some way a "defense wall", if one may use the expression, is thrown up and the eye remains immune even if other constitutional disturbances take place. In other cases arthritis in the small joints and uveal disease go hand in hand. These latter cases represent a definite toxic saturation, and other manifestations, digestive, etc., are apt to occur, so that it is at times very hard to say that the infection leading to the sensitization began in the head. The question of the priority of the infection in tonsils or sinuses is also a very interesting one, which, however, cannot be considered here. Some authorities believe that bacterial sensitization commonly begins in the head, and it is at all events certain that the eye condition, whatever it may be, represents a cut down in the "defense" and that if the process is to be stopped one of the principal (if not the principal) foci of infection must be attacked. There are advocates of conservative measures, such as treatment by vaccines, local antiseptic measures, etc. In exceptional cases such may be justified, but in cases where time is of importance, that is where destructive changes in the eye are apt to take place, the author wishes to place himself on record as favoring radical operation as soon as a diagnosis of strong probability can be made. Conservative measures do not stop the process quickly enough, and the slight risk of a properly done sinus exenteration is not to be weighed against the certainty of serious damage to the vision if delay occurs.

Frontal sinus infections alone do not commonly affect the eye, though it must always be remembered that anatomic anomalies occur very frequently, and cases have been studied where the frontal is very large and extends back in direct communication with the ethmoids or even the sphenoid. While general infection is the rule rather than the exception, nevertheless the infection usually begins in one definite locality, often encouraged by lack of local drainage. In primary frontal infections the process is not deep enough to attack the deeper parts of the eye.

Infections of the ethmoid commonly give uveal disturbances, iritis, choroiditis or, less commonly, retinitis. Orbital cellulitis also occurs as the result of direct extension, but this is so well known that it needs only to be mentioned in passing. Where the infection is active in the posterior ethmoids, sphenoidal infection usually participates and retinal inflammation may be accompanied by a low grade plastic neuritis. Primary sphenoidal infection causes a neuritis, retrobulbar in type, or the peculiar functional depression of unknown pathology which has already been mentioned. It is somewhat doubtful if sphenoidal disease alone can cause posterior segment disturbances other than those of the nerve that have been mentioned. It is still more doubtful that they can cause anterior disturbances, iritis and cyclitis. However, the question is largely an academic one, as the association between the ethmoids and the sphenoid is so intimate that the wisest course to pursue in operating is to open both, and this is usually done by the most experienced rhinologists.

Antrum infection is, like tonsillar infection, probably more definitely focal in character and is, as a rule, less extensive, slower and altogether less serious in character than other types. It occurs as a small plastic patch or a scotoma without apparent lesion. The degree of the eye trouble depends somewhat on the severity of the antral process, and in cases where an extensive purulent process occurs the uveal disturbance may be severe. Numbers of the severe purulent type of antral infection with eye complications have been reported. They do not occur so commonly in large cities, however, probably because the trouble is discovered and treated in its early stages.

Ocular disturbances from tonsillar infection vary widely in proportion to the severity of the tonsillar process. In general it may be said that the process is more rapid and may be more severe than in sinus infections.

Clinical course when operation has been done: When one studies the course of uveal disease the question of sensitization presents itself very strongly. Undoubtedly the sooner a toxic process is

stopped the more promptly and completely recovery occurs. This can hardly be considered as a question of mechanical changes, for a considerable degree of plastic exudation can occur without leaving permanent damage. It is also fairly certain that iritic attacks in the presence of a toxic process become more intense and more frequent as time goes on without any discoverable increase in the severity of the toxic process. It follows then that in sinus toxemia an iritis yields more quickly and completely if the operation be done early. Frequently the attacks stop short and never recur. In cases that have run a longer course the iris seems more sensitive and relapsing attacks occur for a time even after the main focus is destroyed. The attacks gradually become less in intensity and finally stop. In cases that have gone too far it is conceivable that the local disturbances are too great to permit of recovery. Where the attacks stop short after operation the presumptive evidence in favor of the correctness of the diagnosis is very strong. Where the attacks go on, the correctness of the diagnosis remains to a certain extent in doubt. Yet it is certain that an iritis may be of sinus origin and yet the period of operation may be too late for a good result. Where the dividing line occurs is a matter of considerable difficulty in judgment in some cases.

Choroiditis, and indeed retinitis as well, frequently stops short when a sinus operation is done, but the appearance is masked by floating vitreous opacities, which may be very slow in absorbing. When sufficient absorption has occurred a view of the process shows that resolution and cicatrization have occurred in a relatively short period of time. While it is impossible to be very definite on this point, it may be said that the period of resolution seems astonishingly short in a successful sinus case. A choroiditis which would probably take two or three months to resolve when due to other causes will clear up in a few weeks when a focal cause has been removed, and the rapidity of its resolution is, as has been said before, a fairly certain confirmation of the correctness of the diagnosis. Retrobulbar neuritis, and the cases of functional disturbance of the optic nerve of unknown pathology, frequently clear up in a few days. Cases in which the vision has been reduced to little more than light perception frequently clear up in a day or two with vision restored to normal. This again depends upon an early operation before atrophic changes have taken place. Plastic neuritis is of course a much slower affair, but even in these cases it is apparent in a few days that the process is declining, and its further course, even if local tissue destruction takes place, leaves very little doubt that the focus has been reached.

Where no operation has been done: In this connection, the correctness of the diagnosis is always open to certain doubts. It is most probable, however, that at times the sinus disease runs a certain course and then subsides, leaving more or less tissue damage. Probably the osteitis, if one may use the expression, reaches its limit, the bone becomes eburnated, and the production of toxins ceases. It is admitted that we are on uncertain ground in this assumption, and yet it is difficult to explain otherwise the clinical course which some cases pursue. In a given case it is impossible to forecast the extent of the process, and it follows that the surgical removal of the focus is much the safer procedure. Certain general observations may be made.

In iritis the disease is apt to continue until the ciliary body and choroid are involved and cataract with serious lymphatic changes occur. In choroiditis the vitreous is apt to become filled with exudates which remain more or less permanent, and tension changes with retinal detachment may follow. In retinitis a very wide extent of retinal involvement is the rule rather than the exception, and the vascular thromboses and general vascular disease may lead to secondary glaucoma, of the so-called hemorrhagic variety. Plastic neuritis leads to extensive atrophy, while retrobulbar neuritis always leads to a certain amount of secondary atrophy with a white nerve and reduced vision, conditions which, however, do not always get worse as time goes on. Such cases may retain a vision of from 20/200 to 20/50 for years. It is probably very unusual for a nerve disturbance due to sinus disease to recover completely unless a sinus operation be done.

General considerations: The question that occurs most forcibly in this study is: "What is the proper attitude for the ophthalmologist to take when handling a case where there is a strong presumption of sinus disease?" There will most frequently be a report from the rhinologist of "Nothing definite found", or at any rate the findings will be so slight that he will not on his own responsibility wish to decide on operative procedure. The question was a much more difficult one in the days when the sphenoethmoid operation was technically not so well worked out. Infective processes, hemorrhage, even meningitis, occurred, and the risks were much greater. At the present time, however, complications are rare, at least in the hands of those with whom the writer is privileged to be most closely associated. Cases leave the hospital in as short a period of time as a week, and the physical strain seems to amount to very little. At the same time it is evident to one who has seen something of the work that a correct

technique is a matter of vital importance, and that to advise operation where one is uncertain as to how it will be performed is unthinkable. Given then the co-operation of a skilled rhinologist it seems wrong, in the endeavor to make an absolute diagnosis, to delay in cases where destructive tissue changes are taking place. The results depend largely on the stage of the operation. The various forms of nerve disease give excellent visual results even when the case is not seen very early.

Retinochoroiditis is very apt to leave a permanent scotoma even when an early operation is done, though this of course depends on the violence of the onset. Iritis may run a long course and still clear up with good vision when operation is done, but it must be remembered that in the late cases degenerative changes, lens, and vitreous opacities may occur later as sequelae; and again, as has so often been said, we are impressed with the value of early operation.

The question of recurrence after operation is an interesting and important one. Is the process in the sinuses entirely a local one, or part of a general sensitization? It seems probable that the latter view is the more correct one, for while many cases, perhaps the majority, clear up after one operation, there are cases of recurrence which seem to be due to a recrudescence of the infective process. Also there are cases in which the removal of the tonsils, or the treatment of an intestinal infection, suffices to permit the individual to obtain control of what seems to be a definite sinus process. However, the decision to trust to such an event is an exceedingly important and, in some respects, a dangerous one, and certainly in the presence of an eye infection of any violence, an operation stops the local process for the time being, perhaps permanently, and may remove so much of the infective source that resistance will rise and control be obtained.

The reported series of cases demonstrates conclusively the advantages of early operation and the fatal consequences of loss of time.

(To be continued.)

THE FALSETTO VOICE.*

DR. ROBERT RIDPATH, Philadelphia.

Having been asked on several occasions after presenting a paper or talk on voice production, "Doctor, what is the falsetto voice and how is it produced?" or "How is it possible for a man to have a normal speaking and singing voice and suddenly be able to change into a falsetto voice?" I have decided to compose a resumé of the knowledge on this subject and present it in this paper.

As indicated by its name, the falsetto voice is self-descriptive and is a false voice, characterized by a thin, high-pitched, piping quality. It belongs to the head tones and the resonating chambers associated are chiefly the accessory sinuses of the head. Although simulating the undeveloped infantile or child's voice in its high-pitched quality, it lacks its strength and volume. Sometimes described as the eunuchoid voice, it also differs in volume and strength, and whereas the eunuch's voice is a natural one for him, the falsetto voice requires considerable effort and strength, with an adjustment of the larynx and associated muscular elements for its production.

Two entirely different theories seem to voice the ideas throughout the small amount of literature on the subject. The first is that by bringing the extrinsic muscles into play, lifting the anterior portion of the thyroid cartilage and depressing the posterior part, thus reducing the length of the larynx and changing the direction of the vocal vibrations. The tongue also would be depressed backwards, thus forcing the epiglottis against the posterior pharyngeal wall. The second theory is that the whole larynx is raised, the aryepiglotteal membranes or folds contract and in this manner lengthen the tube but decrease its calibre.

According to the rules of acoustics, as applied to resonating tubes, the pitch of the tone becomes higher as the size of the tube is reduced in width.

Before going into the actual mechanism of the falsetto voice, let us for a moment consider the elements associated in ordinary phonatory or singing effort. First we have the cartilaginous movements, the forward and backward direction of the thyroid articulating by its two lesser horns on the lateral wall of the cricoid. The two arytenoid cartilages articulating on the crest of the cricoid with its triple move-

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ments for approximating the cords and a like number of movements to open the glottis for respiratory purposes; the epiglottis, composed of elastic cartilage, is shaped and necessarily changed into many forms during ordinary phonatory effort. The muscular elements are divided into two groups, the intrinsic muscles and the extrinsic muscles. The intrinsic muscles are again divided according to their movements or specific action and designated adductors or closures of the glottis and the abductors or openers of the glottis. The group of adductors, the cricoidarytenoideus lateralis, the thyroidarytenoideus and the transversalis or interarytenoideus, are known as the phonatory muscles, whereas the cricoidarytenoideus posticus is described as the respiratory muscle.

The production of ordinary phonatory effort or sound is therefore brought about by the adductor muscles. Due to the stimuli received, the arytenoids and the cords as well, approach each other by the contractive action of the transversalis or interarytenoideus muscle. The cords are then made tense or stretched by the contraction of the fibres of the associated constrictor muscles, so that the interarytenoidian space almost disappears. The glottis is thus reduced to a narrow chink and this is the vision of the so-called medium range of speech. The cords are then thrown into vibration by the blast of air against their edges from below upwards. In the human being, these vibrations are changed into articulated voice or speech by the tongue, teeth, lips, hard palate, etc. Speech is modified into pleasant or unpleasant sounds by the resonators—the ventricles, pharyngeal wall, buccal cavities and the accessory sinuses of the head.

In ordinary speech we use about one-half an octave, whereas in song we use two-and-a-half or three octaves. Now, where is the difference, or how is this possible? We are well aware that if we shorten a vibrating cord, we have a higher note. We are also cognizant of the fact that if a vibrating cord is stretched, we also have a higher note. Knowing these facts and knowing also that wonderfully constructed and flexible sound instrument—the larynx—we are not surprised when, through the action of the extrinsic muscles, particularly the cricothyroideus media in conjunction with the interarytenoideus, both these conditions are possible.

These, then, are the movements and mechanical essentials for speech and song. Song is divided into its many divisions, according to the length of the vocal cords and the number of vibrations possible in the individual cases. We therefore have the soprano, contralto, tenor, baritone and bass, with their many subdivisions.

In the production of head or falsetto notes, the glottis is even more tightly closed behind. This posterior closure reaches its highest

degree in the production of so-called ventriloquist's voice, in which the convulsive contraction of the adductors may even result in overlapping of the true vocal cords in their posterior half.

Holmes maintains that the glottis is constricted to an extent that the false cords practically meet in the median line and the vocal bands are scarcely visible. This, as suggested by Voorhees, is a "satisfying, even if highly theoretical, explanation, but does not at all describe the head voice which is resonated from the highest levels of the pharynx, thus shutting off the postnasal space."

G. Hudson MacKuen insisted that "if the larynx be pulled up high in the throat, we shall have a thin, high-pitched voice," but he failed to reason that by the double action of the cricothyroideus muscle having its origin from the arch of the crocoid cartilage, its muscular fibres divided into two parts, one division extending superiorly, coving the middle cricothyroidian ligament and is inserted into the median line of the thyroid; the other division, radiating backward on an angle, is inserted into the lateral side of the plate of the thyroid cartilage. One can, therefore, very readily understand that when the nerve stimuli is received by this muscle and contraction of its fibres takes place, the thyroid cartilage would be elevated anteriorly and depressed posteriorly and by this same action, through the articulation of this cartilage with the cricoid, this, the cricoid, would necessarily also be depressed posteriorly, thus shortening the tube to quite a degree.

In conjunction with the changed poise of the larynx, we have a lowering or falling backward of the base of the tongue; this, in turn, as mentioned in the first part of this paper, forces the epiglottis backward, thus changing the shape of the resonators and the direction of the vibrations or sound.

In the chest voice, the vocal cords vibrate in their whole length. In the head voice, only part of the cord vibrates. To produce sounds an octave above, as required in the falsetto voice, necessitates still another change in the cords and whereas the posterior one-third of the cord vibrates in the head voice, the whole is still tense and close together throughout its entire length. In the production of this vocal anomaly we have vibration only of the posterior one-fourth of the cord, an overlapping of the cord at this point, an abnormal contraction of the interarytenoideus, so that the interarytenoidian space is practically eliminated. The extra tonicity of this muscle apparently lessening the contractibility of the other constrictor muscles, allowing a leakage anteriorly, this causing a forced action and suggesting a lack of muscular control, besides a disturbed balance in the respiratory tract.

N.E. Cor. 18th and Chestnut Streets.

SOUNDPROOF ROOMS.*

DR. DANA W. DRURY, Boston.

It is well known that some churches, halls, theatres or other buildings are acoustically unsatisfactory. They prove trying to the speakers or musical performers, to the audience, or to both. Others are good for speech but bad for music, or vice versa, while yet others may be acceptable for both speech and music. The principles and problems underlying the unsuccessful design or remedial treatment of any room to be used for a specific purpose long failed to receive the attention which, from the importance of the subject, they deserved; but considerable progress in this direction has been made during the past several years.

The sounds uttered by a speaker or tone instrument reach the auditor somewhat enfeebled by the distance passed over, but have, on the other hand, various echoes, reverberations or distortions added to them by the floor, walls, ceiling, furniture and occupants of the room. Thus, sound, being energy, once produced in a confined space, will continue until it is either transmitted by the boundary walls or is transformed into some other kind of energy, which process is usually called absorption.

Just as a book through the ages has been evolved from a bulky volume, mammoth in proportions to the thin, beautiful models of the present day, the building partition has been skeletonized from the heavy, ponderous walls to a thinner, lighter and more uniform material, easier to handle. The increasing demand for quiet in buildings and auditoriums has stimulated the use and development of materials with sound absorbing qualities. Thus, the transmission of sound through a partition resolves the complex phenomena upon a number of factors, such as inertia, rigidity, minute structure and conductivity of vibration.

The room in question that I have had the opportunity of using, the William E. Nickerson Acoustic Laboratory, might be described as follows: It is a room built within a room in order to secure two independent walls for each partition. Against the plaster of the original partition a layer of Housline was installed; then a layer of 22-

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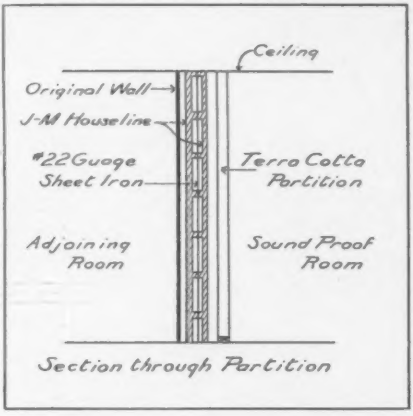
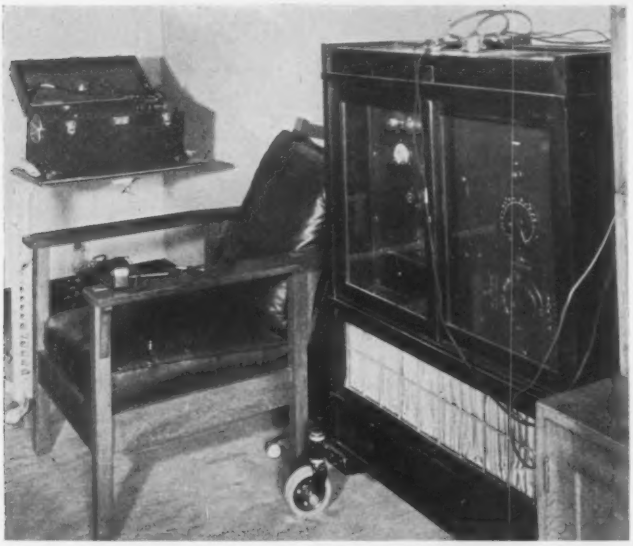
gauge sheet iron, with another layer of Housline against this. A 4-inch terra cotta wall was then installed on a base entirely separate from the other partition. This terra cotta partition was then plastered on the exposed side and thickly painted. The ceiling of the room was then treated with Johns-Manville acoustical felt, covered by muslin membrane, which was furred down approximately 1 inch below the surface of the felt. The original room having two windows, the sashes were removed and replaced in cement, the joints furred with weather stripping. The second wall, 9 inches interior to the original area, had two windows placed as in the original wall. The floor is mosaic laid in cement, on top of which is a heavy battleship linoleum cemented. Above this 1-inch felt was placed, covered by a very heavy sail cloth and thickly painted. All this was over the



original floor with an intermediate air space. The room is closed with a heavy ice box door set into a cushioned furring of strippings and felt. The ventilation of the closed room is provided for very ingeniously by two Stewart high and low pass filters. This arrangement is a hollow tubed disc, 4 inches in diameter, set in felt through the two walls into an adjoining small motor room. Inside the copper tube placed at measured distances are a series of aluminum discs set in felt, the outer edge of the aluminum disc coming into the lumen of the outer disc, a matter of an inch. Between each aluminum disc is a mass of felt. The filter connected with the motor room allows the aid to be forced into the room at the mopboard but does not pass in any sound. The second filter, built in the same way, extends

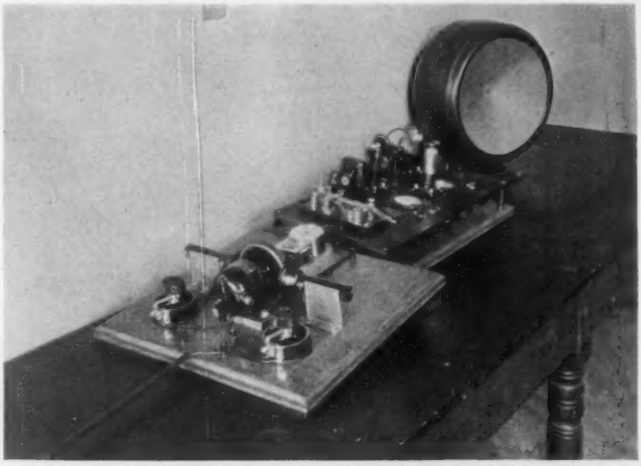
through the ceiling into the outside air. As to what is in the room, the question resolved itself broadly into two variables, namely, shape (including size), and materials (including the furnishings).

An essential in determining the choice of partition types is the relative degree of soundproofness desired and while certain theories that have developed from the results of practical experience have been used as guides, to build complete partitions, walls and floors of sound absorbing material of high efficiency is often impracticable and always very costly. Better to build the structure and partitions of materials generally used and to interline these building elements with



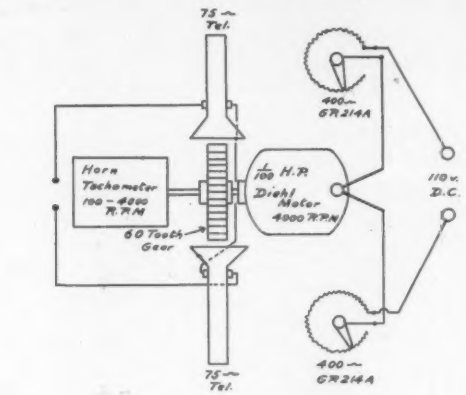
layers or diaphragms of absorbing materials. Felt, felt-paper, mineral wool, slag, asbestos and cork might be mentioned. While we know that sound waves are reflected and refracted, we also know that any discontinuity diminishes the transmission of sound. Thus, an air space between double walls has been found far more efficient as a sound insulator than the same space filled with wood, sawdust or slag, although felt filling was nearly as good as air. Vibrations generated by motors, elevators, street traffic, etc., is thus controlled by the interposition of a discontinuity to the waves, but it has been found that the boundaries of the room should be as rigid as possible,

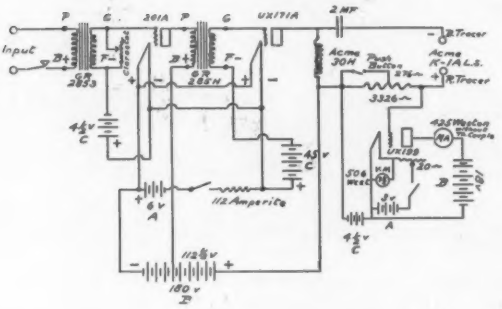
with the openings guarded in special ways. Vent ducts of various sorts are the most difficult to control and our room has only wires encased in suitable containers entering into wall outlets. Mass seemed to be the decisive property for low frequency soundproofing and stiffness (enabling the structure to vibrate as a whole) for the low frequency sources. I might add that an open window is used to determine the coefficient of all absorbing materials. This coefficient is held as one. The effect of sound is intensified and the transmission sound increased in volume if the natural period of the partition is in tune with the passing sound waves. Again, it is affected if the walls are not rigid and nails pass through the insulation.



A very important consideration is the painting and decoration of materials within the room. If such painting closes the pores of the material or if painting a membrane stiffens it, the absorbing efficiency is reduced. The spraying of paint is not apparently as serious as that applied with a brush. The sound incident on a material is reflected, absorbed and transmitted. Thus, when such a material is installed on the walls of a room, its absorbing effect includes the transmitted sound as well as the pure absorption in the material. In this sense an open window is considered a perfect absorber, but it is really a perfect transmitter. Hollow blocks do not stop sound, but are a positive detriment. Metal laths and plaster make a superior partition. The metal lath core, because of its open mesh, not only

allows the construction of a homogeneous plaster medium that is continuous from one face through the metal lath to the opposite face, but it also reinforces the partition. It has therefore the desirable quality of inertia with increased rigidity. Again, it is of interest to remember the ease with which sound passes repeated layers of calico, cambric, silk, flannel and other materials. It freely passes through





all these substances in thicknesses sufficient to intercept the light of the sun.

The atmosphere exercises a selective choice upon the waves of sound. which varies from day to day, and even from hour to hour. Thus, it is seen that it is sometimes favorable to the transmission of the longer, and at other times favorable to the shorter waves. This is noticeable in a room unless the noise is cut down to a minimum. There is also noticed in these rooms a good deal of focusing, inter-

ferences and resonance effects, so that regions of comparative loudness and silence are produced. Large, bare, unbroken wall spaces of stone, brick or plaster may produce very objectionable echoes, which may be broken up by dampening the corners or the walls directly by heavy felt. Lastly, it will be noted that the ordinary soundproof room is "dead", and causes a person to unconsciously raise the spoken voice.

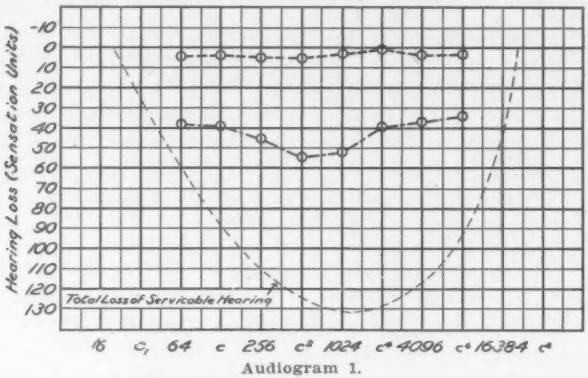
As a sample of the value of a soundproof room we have carried out a series of audiometer studies in air and bone conduction without noise and in the presence of a measured tone, both as to its pitch and intensity on a series of ten selected normal individuals, male and female, with the following interesting data. The audiometer used is that of the Western Electric Company. The bone conduction was performed by a bone conduction receiver also made by the Western Electric Company. It is classed as No. D-80904 and produces a steady vibration of fixed pitch and of controllable magnitude at each of the frequencies provided by the audiometer.

The tone generator consists of three parts: the tone generator, the amplifier and the loud speaker. The tone generator consists of a small, variable speed motor which revolves a gear between the poles of two bipolar telephone receivers. The frequency of the tone is determined by a reading of the "direct-reading" tachometer which is attached to the shaft of the motor. The speed of the motor can be varied so that tones from 100 to 4,000 cycles per second can be obtained. The alternating current output of the tone generator is amplified by a two-stage vacuum tube amplifier. The first stage of this amplifier is a transformer coupled stage using a 201A vacuum tube. The second stage is also a transformer coupled, but uses a 171A power amplifier vacuum tube. Incorporated in this amplifier is a vacuum tube voltmeter used as a volume indicator, which enables the operator to duplicate the input currents to the loud speaker. The first stage of the amplifier is shunted by a variable resistor so that by means of the volume indicator the operator can adjust the loud speaker so that it will have a given electrical imput at a given frequency and therefore the same sound output. In actual operation, the instrument is calibrated for different frequencies (as read from the tachometer), with varying sound intensities (as read from the volume indicator). After the instrument is once calibrated in this manner, any sound intensity at any frequency can be duplicated by reference to the calibration, it being merely necessary to adjust the speed of the motor until the tachometer gives the desired frequency

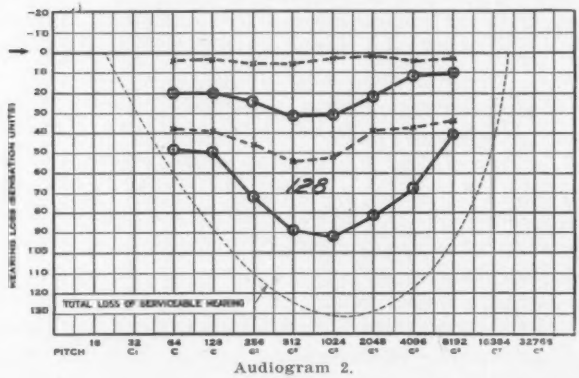
and adjust the volume until the volume indicator (galvanometer) gives the value shown on the calibration curve for this frequency.

As this is a preliminary report of a study embracing several related problems we have in mind, I desire to bring the following points to your attention.

Audiogram 1. This graph represents the combined averages for the group tested by air and bone conduction in the soundproof room unaffected by noise. Apparently the bone conduction observa-



Audiogram 1.



Audiogram 2.

tions at 64 d.v. and 8,192 d.v. bears a relationship to each other as 7 is to 5 S.U. The marked dip is noticeable at 512 d.v. and 1,024 d.v.

With the establishment of the base lines both for air and bone conductions, a series of observations have been made over the entire range of the audiometer, using the noise machine at speeds equiva-

lent to the individual points of the former (the audiometer) and making readings at three different intensities, as indicated on the galvanometer. The actual energy values of these points will be determined at a later date. A sample group of averages is given in the following table. Each number represents the average reading for the group at an indicated set of the audiometer and noise machine, with the latter at an intensity of 20 (the galvanometer reading).

TABLE I.

SAMPLE TABLE, ACUITY LOSS RECORD.

Galvanometer 20.

	Pitch (Audiometer)	128	256	512	1,024	2,048
	Noise Machine r.p.m.					
	128	(17.0)	21.0	26.0	21.0	13.0
	256	19.5	(43.0)	46.5	35.0	18.0
Air	512	13.5	17.0	(39.0)	32.0	25.0
	1024	12.0	14.5	18.0	(48.0)	37.0
	2048	12.5	15.0	17.5	15.0	(33.0)
	128	(51.5)	76.0	89.0	84.5	74.0
	256	56.0	(79.0)	80.0	99.0	79.5
Bone	512	47.5	68.5	(93.5)	95.0	82.0
	1024	40.5	70.5	84.0	(86.0)	83.0
	2048	42.5	67.5	85.5	88.5	(89.5)

Inspection of the air conduction shows a general influence on acuity at each frequency which is generally most marked when the noise machine is at a speed near to the audiometric reading. An exception is at the lowest speed (128), where the maximum influence is felt at 512 frequencies. A residual effect also is manifest at the audiometer reading one octave above the noise machine, with the exception again of the low tone (128). The influence of varying pitch in the noise machine on any one audiometric frequency is less uniform but apparently shows a similar general trend.

The bone conduction observations record exceptions to the above but qualitatively demonstrate a certain general similarity, the range maximum effect seemingly including the pitch below as well as that an octave above, the point of coincidence between the noise machine and the audiometer.

There are two primary considerations in this study, *i. e.*, the influence of intensity and that of pitch on the acuity curve.

TABLE II.

INFLUENCE OF INTESITY ON ACUITY.

Average of Readings With Noise Machine at 128, 256 and 512 r.p.m.

Audiometer Pitch		Galvanometer Readings (Intensity) 0*	20	40	60	Mean of 20, 40, 60
	128	4	17	18	19	18.0 + — 1.0
	256	6	27	30	34	30.5 + — 3.5
Air	512	6	38	44	46	42.0 + — 4.0
	1024	4	29	34	38	33.5 + — 4.5
	2048	2	19	24	30	24.5 + — 5.5
	128	41	52	51	54	52.5 + — 1.5
	256	49	74	73	75	74.0 + — 1.0
Bone	512	56	88	88	92	95.5 + — 2.0
	1024	53	93	95	98	95.5 + — 2.5
	2048	44	79	82	84	81.5 + — 2.5

In the table above are assembled all of the group average readings over the range studied, each figure being the grand average of observations made with the noise machine at three different frequencies (128, 256 and 512). The two higher obtained are omitted as the apparatus did not permit of the development of the higher intensities (40 and 60) at these pitches.

It will be noted that in the air conduction the biggest change comes with the first noise (intensity) produced, while with the subsequent increases the changes are very much less. That it is a regular increase with almost the exact number raise in each intensity and pitch range is evident. Variations from the mean are of the order of from 1 to 5.5 units. The zero column means the readings as given in Audiogram I. The bone conduction demonstrates smaller variations in the column of means with about the same relationship on the intensities as with air.

Consideration of the same fundamental data, differently arranged, permits an estimate of the pitch influence. Since the preceding tables show that increasing intensities condition but slight further loss in acuity, the several intensity readings for each pitch of the noise machine may be arranged and the effect of pitch on acuity approximated in this way. The data are assembled in the next table.

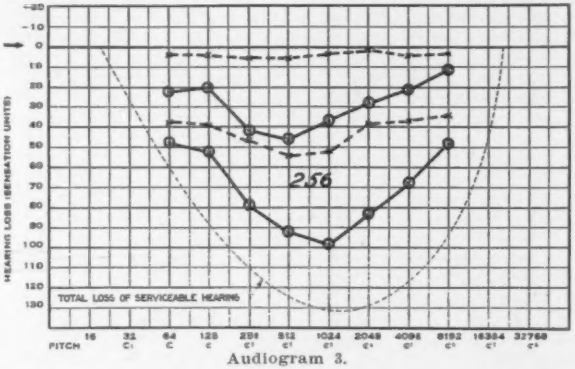
*Noise machine silent.

Table III.

Influence of Pitch On Acuity.

Average of Readings (Audiometer) With Noise Machine at Constant Pitch and All Intensities.

	Noise Machine r.p.m. Pitch (Audiometer)	128	256	512	Mean
	128	19	20	15	17.5 +— 2.5
	256	25	48	18	33.0 +— 15.0
Air	512	35	49	44	42.0 +— 7.0
	1024	28	39	37	33.5 +— 5.5
	2048	19	23	30	24.5 +— 5.5
	128	51	55	51	53.0 +— 2.0
	256	74	73	75	74.0 +— 1.0
Bone	512	90	84	94	89.0 +— 5.0
	1024	90	98	98	94.0 +— 4.0
	2048	78	83	84	81.0 +— 3.0



Audiogram 3.

It will be noted that at 256 noise (summation of all intensities) there is the greatest loss, while at 128 noise the audiometer is not much influenced. At 256 and 512 audiometric reading the corresponding noise has the greatest influence, but still most marked at 256 noise. The bone conduction shows a lesser magnitude of change in the mean column, with about the same relationship as in the air conduction.

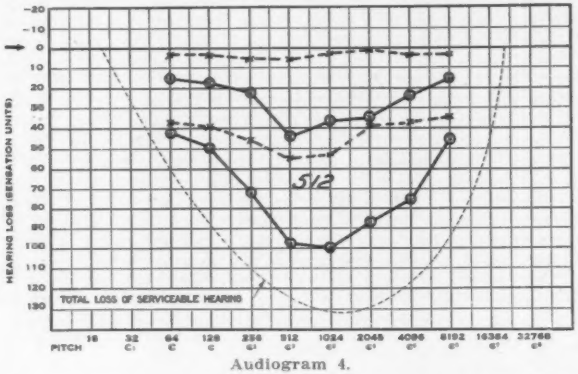
Certain of these effects can be seen most plainly by graphic presentation. In the following series of audiogram curves are shown the points being drawn from the preceding tables.

Audiogram II. Audiogram II illustrates the effect of 128 noise (summation of all intensities), both on air and bone conduction, with the superimposed Audiogram I (without noise, galvanometer at No. 0).

Audiogram III. Audiogram III illustrates the effect of 256 noise (summation of all intensities), both on air and bone conduction, with the superimposed Audiogram I (without noise, galvanometer at No. 0).

Audiogram IV. Audiogram IV illustrates the effect of 512 noise (summation of all intensities), both on air and bone conduction, with the superimposed Audiogram I (without noise, galvanometer at No. 0).

As a summary of these three charts it will be noted graphically that it is pitch and not intensity that exercises the greater effect on the aural acuity curve. Remembering the control readings for air as 4-6-6-4-2 at the central part of the audiogram scale and comparing



Audiogram 4.

these figures under 128 noise, 256 and 512 noise, it will be noted 256 causes the greatest drop, 128 the least, and 512 an intermediate amount. Again remembering the control figures for bone conduction as 41-49-56-53-44, effect of noise on bone conduction will be readily seen. It will be noted further on the three charts the recovery is excellent at the highest frequency, but that the speech area is the hardest hit.

CONCLUSIONS.

1. A thick homogeneous structure has the advantages of greater inertia and rigidity, compared with a thin partition.

2. An air space impedes transmission of sound.

3. The deeper in the ground the soundproof room can be built, the more easily can it be made soundproof.

4. Absorption of sound by materials is due to the porosity, compressibility and elasticity of the substances used.

5. The human factor of concentration varies with one's physical condition, so that it is necessary for satisfactory results to take reverberation measurements only when the observer and the observed are not fatigued.

6. Dissimilarity of ears causes more variation than the errors of the observer's judgment.

7. The ordinary noises of the day affect an aural acuity curve very directly.

8. The observation that pitch more than intensity produces loss of acuity in the normal ear warrants, we think, the conclusion that the ear does distinguish the quality of a note similarly as the eye recognizes color in an object.

The author desires to take this opportunity of expressing his sincerest gratitude to Dr. Allan Winter Rowe for his never failing assistance and gracious courtesies, and his thanks to Dr. Reginal Hunt for his kindness and help with the several drawings.

416 Marlboro Street.

THE DIAGNOSIS OF LARYNGEAL GROWTHS.*

Dr. Charles J. Imperatori, New York.

A very interesting and intriguing problem that the laryngologist is frequently confronted with is the differential diagnosis of a laryngeal growth.

Occasionally one is able to arrive at an exact diagnosis. More commonly, however, this is not so easily done and it is necessary to have the assistance of laboratory findings and a general medical examination before a given diagnosis can be made.

The reason for this is, that the pathological changes of the different growths that occur in the larynx are so similar that the mere clinical observation fails and frequently conditions are misdiagnosed. Haste, as much as anything, may be assigned as the cause for these failure in arriving at a proper diagnosis.

The importance of differentiating these pathological conditions cannot be too strongly stressed. Simple chronic inflammatory lesions are frequently mistaken for malignancies and tubercular growths. A

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routine method should be pursued after the original examination of the larynx and a tentative diagnosis made. Where there is any degree of infiltrations of the surrounding tissues of the vocal cords, this is of greatest importance.

Ordinarily, clinical observations suggest to us as a tentative or working diagnosis that infiltrating lesions of the anterior part of the larynx may be syphilitic and those of the posterior part as tubercular.

A generalized inflammation without distinct invasion of the surrounding tissues and with slight or no loss of motility may be considered as an inflammatory lesion due to some irritation, either occupational or from chronic infection of the sinuses, teeth and tonsils. Alcohol or tobacco should be considered.

Malignant growths may simulate any of these lesions but there is usually invasion of the surrounding tissues and accompanied by loss of motility. Benign growths, such as polyps, varices, fibroma and papilloma, occasionally become surrounded by an inflammatory zone, but there is rarely loss of motility. Slight loss of motility should not be considered as absolute evidence of a malignancy, but it is highly significant that an infiltrating lesion may be malignant. Loss of motility, being dependent on round cell invasion beyond the submucosa, should always be viewed with concern.

A general history of the patient previous to the onset of the symptoms referable to the larynx is of value. Pneumonia, whooping cough, influenza, typhoid fever, chronic tonsillitis and sinusitis are frequently followed by sequelae in the larynx. A history and duration of the symptoms referable to the larynx, such as hoarseness, cough, dyspnea, local or referred pain, hemorrhage and difficulty in swallowing, are to be noted.

An examination of the patient should be done as follows: Rhinolaryngeal observation should include the nasal chambers and sinuses and also transillumination of the latter. The mouth, tongue and teeth, oropharynx, laryngopharynx, epiglottis and larynx should then be examined. In the larynx, attention should be given to observance of the aryepiglottic folds, arytenoids, ventricular bands, sinuses of Morgani, vocal cords and subglottic space.

The general appearance of the mucosa, the loss of function and the cause of improper approximation of the vocal bands are noted. The appearance of a new growth or abnormality and whether there is any loss in continuity of the mucosa are observed.

Specifically should a new growth be observed, its attachment should be considered as to whether it is sessile or pedunculated and

whether its base has invaded this attachment and the amount of loss of motility with the accompanying loss of function.

A general medical examination by an internist should be done, and enlarged glands in the neck noted.

Laboratory methods necessarily should include blood Wassermann, urinalysis and blood chemistry, sputum analysis, Roentgenograms of chest and sinuses. Acceptability of laboratory methods are dependent on the proper relationship they bear toward the clinical findings. These findings are studied and after again investigating the laryngeal condition the diagnosis is either confirmed or further study given. Should the lesion be suspicious of a carcinoma before proceeding with any therapy or surgical methods, a biopsy should be done. This is best done by direct laryngoscopy and with a sharp biting instrument. Preferably, the tissue removed should be in part at the periphery of the growth—that is, removing a piece from the growth near its attachment to the normal tissue.

If necessary, a biopsy should be repeated and particularly so should the clinical observations point toward a malignancy. Negative biopsies in such instances should not be accepted. By a negative biopsy, it is meant that the report is that of chronic inflammation.

SUMMARY.

A relevant previous history of the patient before the onset of the laryngeal symptoms and a notation of the general symptoms.

Laryngeal Symptoms: Onset of hoarseness, cough. Later manifestations of laryngeal involvement, such as dyspnea, pain dysphagia, expectoration and hemorrhage.

Laryngeal Examination: Location of growth, its appearance and attachment. Appearance of the mucosa, loss of function, infiltration and invasion of the surrounding tissues.

Laboratory Methods: Blood, sputum and urinalysis. Roentgenograms of chest, sinuses and teeth.

Direct Laryngoscopy. Biopsy.

When all these findings are assembled and considered, the clinical examination of the larynx again becomes the most important guide to the diagnosis and it alone must be the determining factor in concluding what is the nature of the growth under consideration.

17 East 38th Street.

THE TELEPHONE AND THE EAR.*

DR. J. A. WHITE, Richmond, Va.

This paper is presented to elicit a discussion on the probability or possibility of the telephone doing permanent damage in any way to the organ of hearing. No better audience could be selected than an assemblage of trained otologists of long and wide experience.

The subject has assumed a medico-legal aspect apart from its scientific value because of a recent happening in Richmond, Va., when the telephone company was sued for $35,000 by a young woman who claimed serious damage to her ear and general nervous system by what the telephone people call an "acoustic shock", by which they mean a "sound shock" by excessive noise from the receiver in answering a call. This is not to be confounded with the damage that might occur from lightning during a thunderstorm or from a short circuit accident by a crossing of wires from a high tension conductor. Contrary to the usual way of reporting a case after a consideration of the subject, I will state the case first and then give the results of my investigation by corresponding with other otologists and by what I could gather from the available literature on the question.

The case is as follows: On Sept. 30, 1926, a young woman employed in the largest department store in Richmond picked up the receiver of the telephone to answer a call and immediately dropped it, saying she had been shocked by a very loud noise "which injured her ear and head and resulted in a disturbance of her equilibrium, with physical pain and general disability".

On Oct. 8, 1926, she consulted me and I found no deafness, no nystagmus and no ataxia and was unable to verify her contention, having only her word for it. I regard it as a hysterical manifestation.

On Oct 11 she consulted someone else and was under his treatment for some time and finally entered suit for damages. When she did so, the company's legal representatives called on me and asked me to testify as a witness in the case when it came to trial. I stated I was not familiar with the subject, having never heard of an injury to the ear from the telephone, except from electrical shock, but would

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get the opinion of other otologists before the trial as it might be of some advantage to the company.

It was stated that at the time of the claimed injury it was a perfect day, that other employees around her were also using the phone constantly on the same lines and communications and none were injured or damaged. I was averse to stating the young woman was malingering, and decided to wait until I had some replies to the following questionnaire which was sent to a number of well known otologists:

"I would appreciate very much a prompt reply to these questions, and still more if you will add anything to them that will elucidate a doubtful subject which has assumed a legal aspect: *1*. Have you in your experience had a case of injury to the hearing from the use of the telephone? *2*. If so, what was the nature of the injury and how great the loss of hearing? *3*. Was the trouble produced suddenly or gradually? *4*. Was there any indication of defect in the internal ear apparatus, especially the semicircular canals resulting in vertigo, etc.? *5*. Do you think the sudden click or noise, frequently noted, when the operator, in responding to a call uses the plug to make the connection with another exchange than the one used by the caller, could cause injury to the internal ear? *6*. It is said that violent noises, such as explosions, blasts, firing of cannons, etc., can produce rupture of the drumhead and hemorrhage into the middle or internal ear; but could the noise made by a telephone in making a connection cause similar effects, in your opinion?"

Most of the replies were emphatically negative, but doctors always find some other doctor to differ with them.

One wrote, "I have had no personal experience with an injury to the hearing from the use of a telephone. I do not see, however, any reason why the sudden click or noise experienced by the operator in responding to a call may not be a cause of injury to the internal ear. In fact, I should expect that it would be."

Another wrote that he had seen patients, who claimed they had the ear damaged by violent vibration of the magnetized membrane of the telephone receiver, but he could find no real foundation for the complaint.

Again, certain aural neuroses can be induced in neuropathic (hysteria, psychasthenia) individuals by the constant make and break noises. Also, that in certain internal ear diseases, the extraordinarily loud noises which occasionally occur in making and breaking connection might have a permanently injurious effect, but that in normal ears these same noises might have a transitory effect in dimming hearing and producing tinnitus and vertigo.

And, lastly, another states he has occasionally seen cases of injury to the internal ear from sound concussion and a very few that claimed such injury was due to the accidental explosive sounds occasionally encountered in a telephone, but such injuries had always been restricted to the hearing mechanism and he had never seen a case where a concussion either from telephone or other source had been responsible for a disturbance in the internal ear involving the semicircular canals, and that he had never seen such a case recorded in the literature of internal ear disturbances.

Now, according to Stenger, a trauma or shock from whatever cause which produces what he calls "commotio auris interna", a concussion of the labyrinthine fluids, deafness will result if it affects only the perilymph, whereas if both perilymph and endolymph are affected not only deafness but vertigo and nystagmus will be present.

But this could only occur from a great trauma or a very violent shock, as the membranous labyrinth floats free in the perilymph and, therefore, is protected by the perilymph against any damage except by a very high violent shock. Experiments made during the war of the effects on the internal ear of high degree explosion (shell shock) demonstrated what tremendous violence was necessary to produce concussion of the internal ear. When deafness did occur it was thought to be due to hemorrhage into the labyrinth or paralysis of the organ of Corti and it might be temporary or permanent.

Fortified by the replies to my questions, I concluded that my diagnosis in the first instance was correct and that the patient's trouble of her ear and nervous system was in the same class as "railway spine", which usually gets well when damages are collected.

When the case came to trial the attending specialist stated he was much puzzled as to the nature of the injury, because she had no deafness and no indication of damage to her ear, except that she complained of vertigo. The Calovic reactions were normal. As the veritgo could be brought about by various pathological conditions, he looked elsewhere for the cause, such as eye, cardiac and intestinal trouble, with toxemia. A neurologist and a brain surgeon were consulted, with negative findings, except the diagnosis of probable neurasthenia.

Some weeks after she first went under treatment, it was said she developed nystagmus, upon which the otologist made a diagnosis of "neurosis of the vestibular nerve" caused by a telephone shock. Now, you are all familiar with the statement that neurasthenics sometimes have vertigo and nystagmus (?) without disease of the ear or any injury of the labyrinth. Also, that toxemia produces vertigo and pos-

sibly nystagmus without labyrinthine disease, especially in sufferers from some form of autointoxication due to intestinal troubles or to excessive smoking or drinking. No attempt was made to differentiate her nystagmus, said to have come on weeks after the so-called injury, from true vestibular nystagmus. There was no ataxia at any time, no Romberg. I, therefore, denominated the diagnosis of "vestibular neurosis" as probably correct, provided the adjective were changed into "litigation neurosis".

In looking up the literature of the subject, I found very little to support the contention of internal ear damage from the telephone in persons with normal ears, except from violent electrical shock during a thunderstorm or from a short circuit with a high tension wire. Cases of ruptured drumhead have been recorded from the use of the telephone during storms, as by I. Vels, in 1909, in the Archives of Obrenheil Kunde; by A. F. Koetts, in 1912, in the Medical Fortnightly, of St. Louis, and by others.

In 1879, D. F. M. Pierce, Manchester, England, in the *British Medical Journal,* reported a case of a woman who, whilst using the telephone during a storm, was affected with syncope and deafness, attended by dizziness, nausea and tinnitus. All except the deafness disappeared in a few minutes and the hearing became normal in two weeks. Other reports of the same character have been made.

In 1888, Dr. Clarence Blake read a paper before this Society in the city of Washington on the "Influence of the Use of the Telephone Upon the Hearing Powers", in which he asserted its habitual use would be prejudicial in many cases when the hearing was already impaired, and he founded his conclusions on certain experiments he made, "based on well known facts of the process of accommodation in the middle ear for the transmission of tones of low intensity, of the susceptibility of the peripheral apparatus to shock from sharp sounds of high intensity under the conditions of that process and upon the results of measurements of the vibration of the telephone discs made for the purpose of determining approximately the loss of power between the transmission and receiving telephone". I need not quote these experiments, but I tried to get from the American Telephone Company any information as to what a further investigation along this line would give now, allowing for the great improvement in the telephone apparatus, but was not successful.

The above contention of Dr. Blake has been supported by subsequent writers. In 1889, G. Celle, in the Societe D. Biologie, of Brussels, read a paper on the effect of the telephone on the ear. He stated he had frequent opportunities of observing the deleterious

influence of the telephone upon the hearing in employees of the telephone company. This injurious influence seemed to be due either to excessive strength and closeness of the sound or to the fatigue that is caused by the attention required for this peculiar transmission of sound. There existed in all the cases a certain nervous predisposition; in some, there are found old pathological changes in the ear. The injurious influence of the telephonic sound is analogous to the well known observations in machinists, in whom changes of the drum membrane and of the tympanum are found, and also severe attacks of neuralgia, intense tinnitus, extreme hardness of hearing and vertigo. The conducting and nervous apparatuses are equally affected, as well as the general nervous system.

In 1907, Blegvad publised a paper in the Archives of Ohbrenheil Kunde on the effects of the use of the telephone on the body in general, with especial reference to the ear in employees. This extensive paper begins with a critical review of everything which has been published on the subject. The author's investigations consisted in the examination of 450 telephone operators. In all of those examined, not only was the condition of the ears carefully noted, but especial attention was paid to nervous and other general disturbances which might be referable to the use of the telephone. In 26.4 per cent of the 371 telephone operators with normal hearing, a retraction of the drum was found on the side used in telephoning; the other ear was usually normal. It seems, therefore, quite probable that this anomaly was directly or indirectly caused by the use of the telephone. The use of the telephone as a profession does not cause a diminution of hearing in individuals with normal hearing, nor, on the other hand, is there any proof that acuity of hearing is increased thereby, as is often believed by telephone operators. It is probable that in the course of time the ear becomes accustomed to the use of the telephone and the transmitted voice is better perceived. It is not proven that the regular use of the telephone exerts an unfavorable influence on ear disease, although there are instances where lightning, or very sudden loud noises during the use of the telephone, have aggravated ear disease or have caused it. It is therefore advisable that only individuals with normal ears be employed for telephoning. In a few cases, and generally in individuals nervously disposed, the use of the telephone has caused headache and subjective ear disturbances, as pain, tinnitus, pressure, feeling of fullness in the head, hyperesthesia acoustica. Some of these symptoms have their origin in general nervousness which is brought about by the usual conditions of this pursuit. Anemic, nervously disposed persons should not be em-

ployed. Severe disturbances to the ear from lightning or short circuit have not been observed by the author up to the present time.

M. Delseaux, of Brussels, in February, 1912, at the Belgium Society of Otology, Laryngology and Rhinology reported this case. A woman, age 28 years, working as a telephonist for 12 years, had for four years troubles of the left ear. Painful resonance from slight noises, "algacousee" very marked on break of contact and rupture of communication, painful cramps, fatigue, very rapid in her professional work, etc. Acoumetric examination confirmed the auditory troubles and also hyperesthesia of the labyrinth, no nystagmus but marked vertigo. The treatment was rest from her work. One month later case returned after two days work with a return of the symptoms. Examination showed persistent positive Rinné and some troubles of equilibrium. Capart reported a similar case in 1911.

In 1911, R. Foerster published an elaborate article in the Berliner Klinishe Wochenschnfh. on "Injuries from the Telephone and Their Prevention". He quotes Gradenigo's observation on ruptured drum membrane from both electrical shock and intense noises, and also refers to Bernhardt's paper on telephone accidents to the ear and the nervous system among employees, such as deafness, pain about the ear, various psychic disturbances, etc., but does not mention vertigo or nystagmus, unless he classifies these symptoms under "psychic disturbances". He attributes them to both electric shocks and to what he calls "crackling noises", similar to the sound made by pressing back and forth with the finger on an empty tin can. He states that a lawsuit for damages was instituted in Halle by a victim of such an experience. Most of the cases were hysterical, neurasthenic or hypochhondriac and the effects were not lasting. Also, a majority were females and many of them were menstruating at the time of the so-called injury, and he considered the nervous instability at that time was enough to precipitate the otological and neurological symptoms from telephone noises that would not affect them at other times.

From my investigation into the subject, I would draw the following conclusions:

1. That damage to the ear could possibly result from using the telephone during an electric storm, or from electric shock by a short circuit from a high tension wire, but judging by reports of such cases in the past, the damage would only be temporary. Moreover, the modern safeguards of fuses on each telephone circuit, that would be blown by a very light charge of electricity (about 350 mills.), makes such a possibility practically impossible.

2. That deafness, nausea, tinnitus and vertigo have occasionally been caused by the so-called "acoustic shock" or loud noises sometimes occurring in the use of the telephone, but such effects quickly disappear.

3. That the individuals reporting such effects were usually found to be neurasthenics.

4. That I have not been able to find a single report of damage to the static labyrinth with typical nystagmus, ataxia and vertigo, indicating involvement of the semicircular canals.

5. That the probability of harm to the ear from constant use of the telephone among employees of the telephone company is only to be considered with those employees who already had some otological trouble or were of a special neurotic tendency.

6. That, therefore, only people free from ear trouble of any kind and in a normal physical condition should be employed by the telephone company.

200 East Franklin Street.

RESTRICTION OF BLEEDING AT OPERATION.*

DR. SAMUEL B. WILSON, Philadelphia.

As we all know, the vascularity of the tissues involved in operations on the ear, nose and throat, together with the relatively deep and narrow opening through which the operation must be performed, make a dry operative field very desirable. The same reasons prevent a surgeon from securing this by dextrous sponging and well applied pressure as he does in other regions of the body. This makes it advisable to use some other means to obtain it and usually some form of preparatory treatment is given for the purpose. The intention of these remarks is to suggest combining several well known preparations, so as to help the surgeon and make the patient more comfortable.

The intravenous injection of hemostatic serum, made from the blood of horses, is usually efficient and rapid in its action, but it occasionally induces an allergic reaction in susceptible patients. To increase the good effect and at the same time to guard against this annoying and sometimes serious reaction, it is only necessary to combine with the dose of serum one or two minims of adrenalin and five of obstetrical pituitrin. A satisfactory manner of doing this is

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to draw into a sterile syringe two mils of hemostatic serum, one-and-one-half minims of adrenalin and five of obstetrical pituitrin. Five minims of this mixture should be injected subcutaneously and the patient directed to lie down. In half an hour the remaining portion is injected intravenously and the patient remains recumbent for 15 minutes. The operation may then proceed. Age and defective heart action have not appeared to contraindicate the use of adrenalin, in this small dose. The presence of the pituitrin is helpful and the effect has been better than with larger doses. It is better to repeat it if thought necessary, rather than to give a larger dose primarily, and it is very important that the patient remain recumbent for a time, after receiving the injection.

The physiologic or developmental fault which causes thymism, and about which we know very little, appears also to predispose to passive congestion and thickening of the nasal mucous membrane and to sinus infection and to tonsillar and adenoid disease. Consequently thymism is present, not infrequently, among patients who require operation to relieve these ailments and we find in these sufferers a greater tendency to syncope and to nervous imbalance than in more robust individuals. The injection described appears temporarily to lessen this.

This treatment lessens the time required for clot formation, lessens the tendency to bleeding and helps the patient to maintain his composure, by steadying his heart action. It has been stated that equally good results follow the use of serum by the mouth. The speaker has had no experience with that method; but can state that it is much less satisfactory when given subcutaneously than when the plan just outlined has been followed.

Whle speaking of the control of bleeding, I should like to describe a method of preparing the well known solution of gallic and tannic acids, so as to secure better results than are ordinarily obtained. Three-and-one-half grains of gallic acid and 320 grains of tannic acid should be dissolved by heating, in enough water to make one fluid ounce. It will resemble a thin mucilage and should not be watery nor tend to crystallize. A saturated solution, which is 50 per cent stronger than this may be made, but is less satisfactory to use. If applied freely with an applicator, after any intranasal operation, it obviates packing and assists healing. One-inch gauze sponges moistened with it may be packed into the tonsillar fossae, after a complete tonsillectomy. If the pillars have not been injured, they will remain safely for 12 hours or longer. They may then be removed and will leave dry fossae, looking as though lined with khaki cloth.

2018 Chestnut Street.

IMPROVED ANESTHESIA FOR ANTRUM PUNCTURE BY MEANS OF NOVOCAIN INFILTRATION.*

DR. M. C. MYERSON, New York City.

The relative safety of novocain has been given strong confirmation by all students of local anesthesia. The reports of the committee for the study of toxic effects of local anesthesia, of which Dr. Emil Mayer is chairman, concur in this viewpoint. It should therefore be our aim to substitute novocain for cocain wherever this can be done in our diagnostic and operative work, provided of course that the anesthesia which is produced by novocain is as good or better than that which is secured with cocain. It is unnecessary to dwell upon the relative toxicity of cocain.

The technic of inducing local anesthesia by means of the use of novocain in antrum puncture offers a more rapidly induced and a more perfect anesthesia than has been obtained with the methods at present employed. At the present time anesthesia is induced by means of either a tampon or a cotton-tipped applicator saturated with cocain paste or solution, 5 to 20 per cent, placed against the roof of the inferior meatus. Few will argue that the anesthesia obtained by the use of cocain is invariably perfect or satisfactory. There are some noses where the inferior meatus cannot be packed with a tampon or reached with an applicator. Even in those cases where this area can be readily reached, the anesthesia is not always satisfactory. Besides, one must wait for at least 15 minutes before anesthesia is produced. Some rhinologists wait 30 minutes or more.

The writer employs a solution of 1 per cent novocain with adrenalin, which he injects into the inferior turbinate by means of a fine needle attached to a dental syringe. Thirty minims is the amount usually employed. Occasionally additional solution is used. This is because some of the solution first injected may have leaked out of the needle puncture opening.

The injection is made through the mesial surface of the inferior turbinate almost at its extreme anterior end, high up. The needle is directed so that its point comes in contact with the bony lateral wall of the nose or the bony turbinate just below its attachment to the

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lateral wall. The angle of direction of the needle is approximately 60°, in an upward and outward direction. About ¼ inch of the needle is introduced into the tissues in the average nose.

It is important that a needle of fine calibre be used, for a needle of large calibre creates an opening in the mucous membrane which does not close readily and which permits the injected fluid to escape before anesthesia is produced. The largest calibre of needle that one should use is of the type usually employed for infiltrating the peritonsillar structures preliminary to operation. The ideal needle

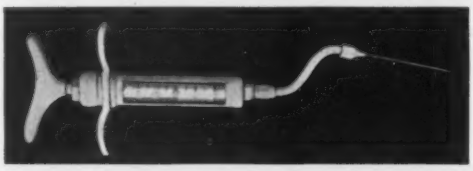

Fig. 1. Dental syringe and needle of type used by author for novocain infiltration of anterior end of inferior turbinate preliminary to antrum puncture.

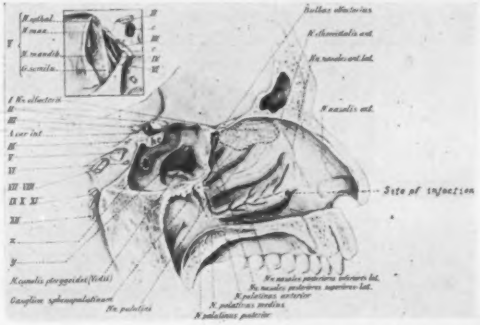

Fig. 2. Showing structure and nerve supply of the lateral nasal wall, and the site of injection. Modified from The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man. J. Parsons Schaeffer, A.M., M.D., Ph.D. P. Blakistons Son & Co., Phil., p. 307.

is a 25-gauge Schimmel needle which the dentists use. The needle should be 2 inches long, so that it will protrude from the nostril while the injection is being made.

When the injection is carried out as above detailed, anesthesia of the lateral nasal wall in the region of the attachment of the inferior turbinate is produced within three minutes. The thoroughness of the anesthesia should be tested with a probe, for it may be necessary to wait an additional two or three minutes in some cases.

In addition to the region of the site of puncture, certain other areas are anesthetized by the injection. The areas which are anesthetized depend upon the quantity of solution injected and upon the proximity of the site of injection to the floor of the nose. Where more than 30 minims have been injected, the soft palate of the same side, the entire inferior turbinate, and the upper portion of the inferior meatus, together with the upper four central teeth of the same side, are anesthetized. When the usual 30 minims of solution are used, the extent of the anesthesia may vary. In some patients the anterior portion of the inferior turbinate and the inferior meatus have been the only areas anesthetized. In others, there has been anesthesia of the two upper central incisors, while in others there has also been the upper central four teeth of the same side. The accompanying illustration of the nerve supply of the nose demonstrates that the inferior turbinate branches coming from the posterior-inferior rami of the sphenopalatine ganglion are the first to become influenced by the injection. If the injected fluid goes far enough, it will reach the posterior palatine nerve. The extensive anesthesia which has been obtained can be explained on a basis of the cancellous structure of the turbinate bone and the bone of the lateral nasal wall through which the novocain solution is diffused. The upper four teeth which are innervated by branches of the infra-orbital nerve receive their anesthesia by absorption of the solution through the bony pyriform fossa and the anterior maxillary wall. The posterior palatine nerve is anesthetized by the same mechanism; the diffusion of the solution through the bony structures until it comes in contact with the nerve in its canal. Anesthetization of the sphenopalatine ganglion does not produce inferior meatus anesthesia in its anterior portion. There is a combination of branches from this source and the anterior ethmoidal nerve, which accounts for the anesthesia.

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MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Meeting of January 13, 1928.

SECTION OF OTO-LARYNGOLOGY.

DR. VIRGIL J. SCHWARTZ reported the following case: Mr. J. H., a white, married male, age 48 years, came in October, 1927, for consultation regarding a hoarseness of four months' duration. Last June some polypi had been removed from the right side of his nose by a very competent rhinologist, and some time afterwards the hoarseness began to be noticed. Subsequent investigation has failed to disclose the slightest connection between these two incidents as such. At the time the writer saw him first he did not cough much, but he did raise a mucus discharge. There was occasional tinnitus. There were no pharyngeal complaints. The patient has two children, both of whom are well. The father died of senility. The mother died of diabetes at the age of 62 years.

On examination at that time Dr. Schwartz noted the following findings: The Pharynx was essentially negative. The tonsils were very small and apparently not pathologic. The ears were negative. The nasal septum was seriously deformed, with a deviation and spur to the left, leaving a deep groove on the right. There was some polypoid degeneration throughout both sides of the nose. On postnasal examination, there was seen a number of polypoid masses on the soft palate, probably originating in the middle meatus of the right side. The choanae were negative otherwise. The larynx showed a smooth, pink, hard, flat mass, about ½-inch in diameter and ⅛ to $\frac{3}{16}$-inch thick, attached directly beneath the petiolus of the epiglottis and, on the right side, extending down to and apparently involving the false cords and somewhat, also, the true vocal cords. There was, apparently, no involvement of the motility of the arytenoids.

The lesion did not fall into any definite pathologic category. The vocal cords were but slightly visible and, where they could be seen, they seemed markedly inflamed. The question of diagnosis immediately arose. There was nothing to suggest tuberculosis, syphilis nor malignancy, although, of course, the latter was strongly suspected. There was no adenopathy at any time. Rhinoscleroma was considered but there were no other evidences of similar pathology in the anterior nares nor in the choanae. The blood Wassermann was negative and a stereoscopic examination of the chest revealed no evidence of lung disease. The entire case is seriously complicated by a very severe cough reflex and sensitivity to touch, even under the strongest local anesthetics. For this reason, treatment and examination has been very difficult, if not at times impossible. A biopsy was finally obtained and examined by Dr. Bell, who stated definitely that the tumor is not tuberculosis nor cancer, but that it is rather a chronic, proliferative inflammation, with a little exudate. The only other possibility, he stated, is sarcoma, but he feels that this can be excluded for the time being and, therefore, he concludes that it must be a chronic inflammatory lesion. The sputum is negative for tubercle bocilli.

During the past three months the lesion has not changed appreciably in its general appearance, but it has become larger by about one-fourth and the apex of the mass, pointing posteriorly, has become quite pointed. This mass has also extended past the midline so as to involve the cord of the left side in its anterior one-third. Various therapeutic measures have been tried, with appar-

ently no results thus far. Among these may be mentioned neosalvarsan, potassium iodid, local treatment with silver nitrate and other medications. At the suggestion of Dr. Stenstrom, of the university, phototherapy was tried, without result. The writer then asked that a course of thorough, deep X-ray treatment be given the patient and this has recently been completed. It will doubtless be some time before the full effect of this treatment may be realized, but so far there has been no diminution in the size of the mass.

It would appear that the only methods of treatment left open are radium implantation, excision, fulguration or cauterization. Dr. Schwartz said he very much disliked, however, to treat the lesion without having at least a good suspicion of what its nature is. At the moment, he was inclined to believe that it is either a chronic inflammatory growth, as Dr. Bell suggested, or a fibroma, and he would very much appreciate any suggestions as to diagnosis or treatment. He felt that it is entirely possible that this lesion may be intimately associated with or possibly a result of the chronic sinusitis, and on that basis it might be well to treat the sinuses; but in view of the enlargement of the tumor mass, it would seem that some more expeditious and immediate method of treatment should be instituted in addition to the sinus treatment. Dr. Schwartz added that two small polypoid masses which appeared on the left vocal cords anteriorly have entirely disappeared since the X-ray treatment.

DISCUSSION.

DR. J. A. WATSON asked whether the lesion was ulcerated before the removal of the piece for biopsy and whether only one Wassermann test was taken.

DR. SCHWARTZ stated that there never had been any ulceration.

DR. D. L. TILDERQUIST asked if any X-ray films had been taken of the mass.

DR. SCHWARTZ said none had been taken, and asked Dr. Tilderquist if he would suspect a foreign body. That might be possible, only in such a case the nature of the lesion would have changed greatly in the interval. Only one Wassermann had been taken and the history was negative.

DR. WATSON said that he did not believe he could help Dr. Schwartz very much, but that he did not consider all the points yet settled that should be settled before arriving at a conclusion. He said that in place of one Wassermann he would want two, three or four Wassermanns taken. Not that he thought, in view of the history, that the lesion was syphilitic; merely that he did not feel that syphilis had yet been eliminated as a possible diagnosis.

He stated that the biopsy had probably settled the question with a good deal of certainty as to whether or not the case was carcinomatous. If Dr. Bell declared after a microscopic examination that the lesion was not a carcinoma, it was almost certainly not a carcinoma; but further than this, he said, one should not place too much confidence in the biopsy. Dr. Bell believed that it was probably an inflammatory lesion, but to illustrate his point, Dr. Watson said he wished to refer to a case that he had already shown before this Academy, in which the same diagnosis was made. The case had been first diagnosed at Rochester as carcinoma and treated with radium. The man was young, only 21 years of age. The hypopharynx was largely filled with the growth; there was no enlargement of the glands of the neck. Feeling that the age of the patient and the absence of glandular metastasis pointed to its being other than carcinoma, Dr. Watson had removed a portion for biopsy and sent it to the university. Drs. Bell, Henrici and C. J. Watson all declared that it was certainly not carcinoma, but it consisted, so far as could be determined, purely of inflammatory or granulomatous tissue and that it contained large numbers of a fungus organism (citromyces), which they thought might have been the causative organism.

After several operations, one an external pharyngotomy, the patient returned to Rochester, where they maintained the diagnosis of carcinoma. Fresh specimens sent to the university elicited the information that the growth was beginning to show evidence of sarcomatous degeneration. Many of the specimens,

both early and late, were then sent to Dr. Ewing in New York, who stated positively that the original specimens were purely granulomatous, but that the later specimens were definitely sarcomatous.

The moral is that even though one may be unable to eliminate carcinoma by biopsy, he certainly cannot eliminate malignancy in the early stages.

DR. SCHWARTZ stated that Dr. Bell did tell him that he had seen cases of this exact nature, which gave the same biopsy findings in the early stage, develop into sarcoma. Dr. Bell stated that they would have to be on the lookout for sarcoma. Dr. Schwartz said he wished to add this in order to justify Dr. Bell.

Difficulties in Making a Diagnosis of Sinusitis. Dr. Henry L. Ulrich.

(*To appear in a subsequent issue of* THE LARYNGOSCOPE.)

DISCUSSION.

DR. F. J. PRATT stated that this subject certainly was very interesting, and he had not thought of this phase of the question.

DR. A. E. SMITH asked Dr. Ulrich if, after these cases are treated and clinically cured, the swelling of the glands subsides.

DR. ULRICH stated that the swelling does subside.

DR. E. J. BROWN asked what form of treatment of these glands Dr. Ulrich had found effective, exclusive of operative work on the sinus.

DR. ULRICH stated that he had found, on himself and others, that quartz light therapy was most effective. Of course where there was a maxillary or frontal sinus that could be drained, he thought drainage should be used, but the ethmoid sinus cases cleared up beautifully with treating the whole body with the quartz lamp. He had not found any other form of treatment to be of benefit.

DR. CARL LARSEN asked Dr. Ulrich if there was pain associated with this adenopathy and, if so, why it was that more patients did not draw the doctor's attention to the neck.

DR. ULRICH stated that this varied a great deal. In his own case there was tenderness in the glands. He thought that in the acute stage one would get enlarged upper cervical glands at first, but when they became enlarged down toward the clavicle the glands gave indication of chronicity.

DR. J. A. PRATT asked if Dr. Ulrich had noticed that when the sinus is closed the glands become tender.

DR. ULRICH stated that he had noticed this, and that when the sinuses opened up the glands receded.

DR. W. W. LEWIS felt that the most blind and blank chapter in this specialty is that of hyperplastic sinus trouble, and he thought that Dr. Ulrich's cases which had been reported back as negative, would be of the hyperplastic type. He stated that Hempstead, of Rochester, had told him they considered suction the most effective means of treatment of this class of cases; that they had stopped washing out the antrum in acute and also in chronic cases, except as a matter of diagnosis, and had substituted the suction treatment and had been getting better results. Dr. Lewis was of the opinion that these hyperplastic cases get through the hands of the rhinologist unrecognized more than any other type of case with which they had to deal.

DR. E. J. BROWN stated that he had been using the exhaust treatment for a good many years and while some of his friends had laughted at him and said it did not amount to much, he believed he had had results from it. As a means of carrying this out, he had had his patients use an inhalant of equal parts of creosote and eucalyptol, inhaling this on going to bed at night and using it for as long a time as possible. In addition to this he had advised holding the nostril 40 times a day and inhaling strongly but short of affecting the membrana tympani, and he believed he had had results. In addition to these measures, Dr. Brown felt that vaccine treatment helped also.

DR. LEWIS believed that the constitutional symptoms from sinus disease are manifold and especially from the hyperplastice type; that in suppurative sinus

disease one did not get near the constitutional poisoning. Dr. Lewis felt that from now on, the injection of iodized oil would probably tell more than any other method of diagnosis used up to this time.

DR. F. J. PRATT stated that he felt this was an important subject and that the members owed it to Dr. Ulrich to follow his suggestion up, and he hoped they might be able to report back to Dr. Ulrich later on.

DR. A. E. SMITH was of the opinion that, so far as suction is concerned, the trend is away from that form of treatment, rather than toward it.

DR. J. A. WATSON stated that we are, of course, liable to find enlarged cervical glands in any inflammatory condition in the nasal sinuses, nose, throat or mouth. As rhinologists, he said, we have probably been remiss in the matter of searching for them, but even having found they, they could not be more than merely suggestive of some focus of infection about the head. Very often the difficulty is not so much in making a diagnosis of some sinus infection as it is in determining which particular sinus is involved. It is rarely that one cannot establish the fact of infection by means of transillumination, Roentgenograms, suction, irrigation and, in the case of the antrum at least, in the last resort direct inspection, which can be carried out by means of the pharyngoscope inserted through a small opening in the nasal wall of the cavity or, better still, in the canine fossae.

He said that one should always remember that inability to obtain pus even by irrigation is not conclusive proof of the absence of sinus infection. Polyposis of the sinuses, particularly of the antrum and ethmoid cells, is not uncommon and in those cases it may not be possible to demonstrate the presence of pus.

Dr. Ulrich's point is valuable, Dr. Watson thought, in that it should put us on our guard. We should not neglect searching for enlarged cervical glands and, having found them, should be diligent to discover their cause, whether in the sinus or elsewhere.

DR. F. N. KNAPP asked Dr. Ulrich if he had watched the glands on the posterior nasopharynx and if he had noticed that these glands were red and enlarged in chronic sinus disease.

DR. ULRICH stated that he would not be able to answer that question very well, and that when seeking a general diagnosis he would not be able to say whether a patient had glands in the pharynx, except as it appeared to be irregular on the surface, because he did not know enough about that particular area.

DR. ROTHSCHILD stated that he thought one of the most valuable means of diagnosis in these doubtful cases was the use of the Holmes nasopharyngoscope. He had seen cases where no changes were visible on anterior rhinoscopy; no discharge, and no changes in the mucosa, which, with the use of the nasopharyngoscope, would disclose a little secretion coming from the ostia or at least slight changes in the mucosa. Dr. Rothschild felt that this instrument is used too seldom by rhinologists.

DR. ULRICH stated that he would like to add one point. On looking up the literature he could not find any reference to this subject, but he ran across one the other day which might be considered rather doubtful, inasmuch as it came from a pediatrician. The latter had mentioned the very thing Dr. Ulrich had discussed and used as a diagnostic procedure. He also had had the same experience with these glands but had had some difficulty in convincing others of his position.

Dr. Ulrich said he had used this method in diagnosing chest conditions; that every once in a while he had a patient who had had X-rays taken and been diagnosed as tuberculosis of the lungs. Dr. Ulrich said that if, in the examination of a patient, he found glands in the neck he would doubt this diagnosis until he had found out whether or not there was sinus involvement. Repeatedly, he had been able to prove this point by disappearance of the chest condition and disappearance of the glands under quartz ligh therapy.

Dr. Ulrich said he hoped there might be made a classification of these glands clinically by groups, and then eventually one might be able to tell which sinus was involved, according to the certain glands or group of glands which showed involvement.

The Use of Iodized Oil in Maxillaries, Sphenoids and Frontals. Lantern Slides. Dr. Hilding Anderson.

(To appear in a subsequent issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. J. A. PRATT asked Dr. Anderson in what percentage of his frontal sinus cases he had been able to pass the catheter.

DR. ANDERSON stated that he had not figured out the percentage, but he had been able to get into most of them. The ureteral catheter is very pliable and if one once gets it in, it will follow right along. In answer to the question as to what the toxic symptoms were in these cases, Dr. Anderson stated that nausea was the chief symptom, and one patient vomited. Two patients were nausteated, he recalled distinctly.

DR. W. H. CONNER stated that the question arose in his mind, after determining that a thickened membrane existed in the sinus, as to what was to be done about it. He felt that there were different opinions as to just how radical treatment is called for in these conditions. Some say to remove the polyps that are visible, and others say to clean out all diseased mucous membrane in the maxillary sinus. He thought an exchange of opinion on this phase of the subject would be of value.

DR. ANDERSON stated that this paper did not discuss treatment at all, but simply called attention to the method of diagnosis with iodized oil.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY.

Meeting of April 2, 1928.

COLLEGE OF PHYSICIANS.

Treatment of Chronic Antrum Disease. Dr. Ross Hall Skillern.

(Published in full in this issue.)

DISCUSSION.

DR. PHILIP S. STOUT: You do not mention transillumination. Do you use this or do you get along without it?

DR. GEORGE M. COATES: Do you remove all the mucosa or only such parts as are diseased? What do you do when atrophy of the mucosa is present?

DR. BENJAMIN H. SHUSTER: What is your objection to removing a piece of the inferior turbinate? Ofttimes in attempting to introduce a heavy trocar into the antrum the inferior turbinate would be in the way and then, too, after the opening was made the mucous membrane would swell up and occlude the fenestration, and I was unable to make use of the opening for irrigation. I, therefore, remove a piece from the anterior portion of the inferior turbinate.

DR. ROSS H. SKILLERN, closing discussion, said that he removed only the mucosa which he considered diseased. This was rather a large order because it was sometimes very difficult to determine. It made no difference whether polypoid tissue was present or the mucosa was atrophied, the rule was to clean everything away that did not look normal. In that way the danger of reinfection was reduced to a minimum. As regards transillumination, he used it occasionally but did not place a great deal of confidence in it. He would not operate on a case just from positive transillumination evidence alone. It was perfectly allright as a corroborative feature, but too much dependence should not be placed upon it. With reference to removing part of the bone of the inferior turbinate so as to enter the antrum wall easily, Dr. Skillern said that it should not be done, because of the probability of substituting one pathological condition for another. If he had an antrum condition he would want that

treatment instituted which would permit the nasal wall to function just as well as the other after the antrum pathology was removed. He said that the goal we should all strive for was to bring the operative area as close to normal as possible. This was the ideal end result.

DR. HENRY S. WIEDER: Dr. Skillern, when you do these operations do you completely remove the mucosa or only the polypoid tissue and allow aeration and drainage to do the rest?

The Falsetto Voice. Dr. Robert F. Ridpath.

(Published in full in this issue.)

DISCUSSION.

DR. P. S. STOUT: I heard Theodore Roosevelt speak several times and he would suddenly break out in a falsetto voice during his speech. Was it something he had to do or was it something beyond his control? Someone once said he had a weak voice or some laryngeal trouble and while in Europe he was taught to use his larynx, producing this falsetto voice, and from that time on he had this apparently falsetto voice during part of a speech, providing the speech was an hour or more in duration and the audience very large.

DR. J. A. BABBITT: Is it possible to see the overlapping of the cords which the essayist mentions during the examination of the patient?

DR. HENRY S. WIEDER: I remember a classmate who had a high falsetto voice. He visited Dr. Hudson Makuen and under his direction his voice was completely altered to a basso within a period of about four weeks. During this time he informed me he was not allowed to speak a word except in the Doctor's office, when, by the use of some manipulation and vocal exercises, he accomplished the desired result. Can Dr. Ridpath give any idea as to what method was pursued in this case as I have never heard of any similar one?

DR. ROBERT F. RIDPATH, closing discussion: I was not aware that Theodore Roosevelt had a falsetto voice. People who try to force their voices when speaking are apt to throw the vocal cords in an unusual position, resulting in a leakage of air. To overcome this there is a tendency to squeeze the throat. Good vocal teachers in their primary instructions will correct this fault. The probable answer to Theodore Roosevelt's falsetto voice is that he always forced his voice in order to throw it as far as possible. A falsetto voice may occur in both sexes, although much more frequently in the male. One of the first cases that I ever came in contact with was a young girl, about 16 years of age, whose voice was markedly falsetto. After about five or six years the condition was corrected. We must realize that the voice changes at the time of puberty and that the character of this change depends upon the rapidity or the slowness with which the larynx grows at this time. If the larynx grows quickly then a small or sharp voice results, like the tenor. If the larynx grows slowly then the large voice of the basso is produced. In the tenor the cords are necessarily short as compared to the basso or baritone; the latter requiring several years for full development and for full change of voice. The falsetto voice is simply a continuance of the infantile voice with an enlarged larynx and in the production of the falsetto only the posterior portions of the vocal cords are in apposition, the anterior portions taking no part in the procedure. It is possible that the falsetto voice can continue through life without the person being conscious of it and give one the impression that it is eunuchoid in character.

In answer to Dr. Babbitt's question as to whether the cords can be seen overlapping during the examination, I would say that I have seen it a number of times. Dr. Bricker, who is here tonight, can give you a correct example of the falsetto voice.

DR. SACKS BRICKER: I never had a singing voice, but I noticed that at frat meetings when we would sing that I could never keep in pitch with the others because occasionally my voice would run way over the top. One evening I attended a musical performance with a teacher of mine and as I was humming one of the song hits while leaving the theatre my voice ran to C over high C. This does not always happen, but just at that moment I happened to strike a false tone.